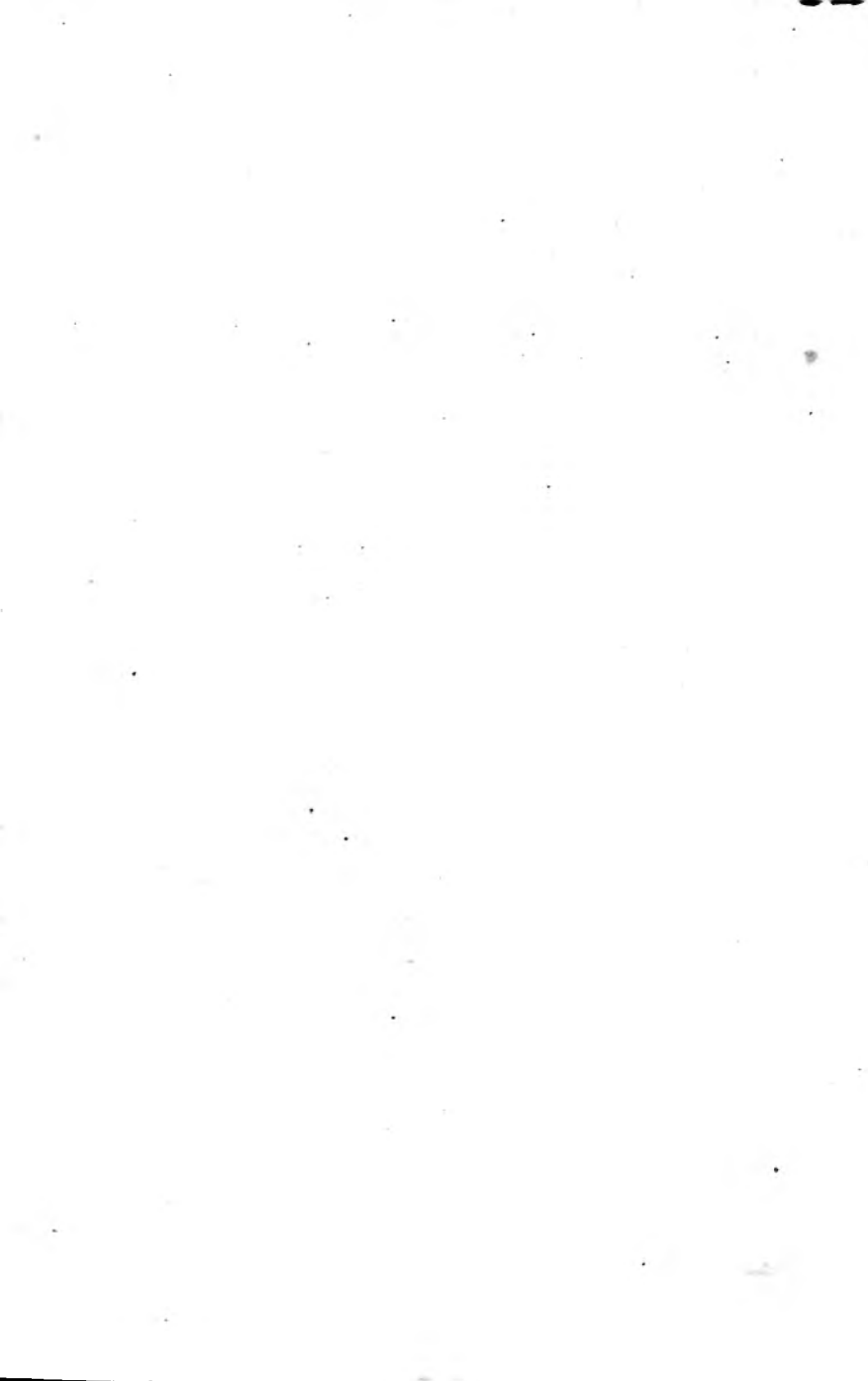


**GENERAL INSTRUCTIONS  
FOR  
HYDROGRAPHIC SURVEYORS**

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**1945**



**GENERAL INSTRUCTIONS**  
FOR THE  
**HYDROGRAPHIC SURVEYORS**  
OF  
**THE ADMIRALTY.**

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*NINTH EDITION,*

1945.

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LONDON:

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1945



*NOTICE TO 9th EDITION.*

*These Instructions were last revised in 1938 upon the issue of the " Admiralty Manual of Hydrographic Surveying," 1938, and have since been brought up to date.*

*They are to be carefully studied, and the directions contained in them closely adhered to by all Hydrographic Surveyors in H.M. Navy.*

*All former Editions, as well as all Memoranda relating thereto, are hereby cancelled.*

*J. A. EDGELL,  
Vice-Admiral and  
Hydrographer of the Navy.*



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## PREFACE.

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The formation of an accurate chart is the result of many operations, all demanding great care, attention, and method, and intimately connected with the chart are the numerous notes and observations which form the basis of complete sailing directions.

Method is, above all things, necessary, and it is essential that all observations, on which the survey itself is founded, are rendered in a uniform manner, in order that the records may be easily consulted, and the value of the survey tested, either now or in the future.

The need for neatness and accuracy in rendering such returns and records cannot be too strongly emphasised, and all books, forms, etc., must be written up by responsible officers, and strictly in accordance with the instructions. The Hydrographic surveyor should be alert to take advantage of his opportunities of adding to the general scientific knowledge of the world when working in the lesser known quarters of the globe.





## SECTION I.

INSTRUMENTS, SOUNDING MACHINES, SURVEYING STORES  
AND APPLIANCES.

**1. Hydrographic instruments—supply.**—When a surveying vessel is commissioned in England, the hydrographic instruments allowed by establishment, together with any additional instruments necessary in view of the particular work to be undertaken, will be supplied direct from the Hydrographic Department, thus relieving the officer in charge of the survey of the necessity for demanding them. In the event of others, in addition, being considered necessary, a special demand on the Hydrographic Department must at once be made for them, in order that, if their supply is approved, the vessel may receive them prior to her departure.

In the case of a surveying vessel re-commissioning abroad, such hydrographic instruments as are serviceable will be transferred to the new commission, and others will be supplied from the Hydrographic Department in accordance with the demands received from the vessel in question for instruments to complete establishment, or to replace those lost or unserviceable.

As soon as the instruments are received on board, they are to be compared with the list accompanying them, and examined to ascertain whether any have been damaged in transit, and also to see that each instrument is in thorough working order. Any discrepancies or damages are to be reported immediately.

No instruments are to be supplied to anyone other than ships' officers and recorders, except in special circumstances, when a report, giving full details, is to be rendered to the Hydrographer.

The normal establishment of Hydrographic Instruments for Surveying Ships abroad and at home, and the South Coast of England Survey, is as follows :—

NORMAL ESTABLISHMENT OF HYDROGRAPHIC  
INSTRUMENTS.

	Abroad.	Home.	S.C.E.
Addometers .. .. .	1	1	1
Astrolabes, 45°, large or small (complete with stand) ..	1	—	—
Barographs .. .. .	1	1	—
Barometers, aneroid .. .. .	3	2	1
Bottoms, specimens of .. .. .	1	—	—
Bottles, mercury (spare) .. .. .	1	—	—
Boxes, geological specimens .. .. .	1	—	—
Cases, field, leather .. .. .	11	8	3
Chronographs, electric, complete with xylonite scales and battery .. .. .	1	—	—
Compasses—			
Beam, 12-inch to 18-inch .. .. .	2	2	2
" 18 " " 24 " .. .. .	2	2	1
" 24 " " 36 " .. .. .	1	1	1
" 36 " " 54 " .. .. .	2	2	1
" 54 " and above .. .. .	2	2	1
Lever .. .. .	1	1	1
Pen, fixed centre .. .. .	1	1	1
Prismatic, dead beat .. .. .	1	—	—
" small .. .. .	4	2	1
Proportional, large .. .. .	1	1	1

NORMAL ESTABLISHMENT OF HYDROGRAPHIC INSTRUMENTS—*contd.*

	Abroad.	Home.	S.C.E.
Dividers—			
Chord, large .. .. .	1	1	1
" small .. .. .	1	1	1
Pocket .. .. .	7	5	3
Glasses, magnifying—			
Folding, 1½-inch to 2½-inch .. .. .	2	2	2
Hand, 4-inch .. .. .	2	1	1
Tripodial .. .. .	1	1	1
Heliostats, " Galton " .. .. .	3	2	—
Instruments, drawing—			
1st class sets .. .. .	1	1	1
3rd .. .. .	10	7	2
Levels, precision .. .. .	2	1	1
Meters, current .. .. .	2	1	—
Microscopes .. .. .	1	—	—
Poles, ranging .. .. .	12	—	—
Protractors—			
Boxwood or ebonite, 12-inch .. .. .	4	2	2
Circular, brass, 20-inch .. .. .	1	1	—
" Cust," rolling, boxwood, 18-inch .. .. .	1	1	—
" Douglas," 10-inch .. .. .	6	3	2
Rectangular, metal, 12-inch .. .. .	1	1	1
Semi-circular, brass, 18-inch .. .. .	1	1	1
Various, 6-inch to 8-inch .. .. .	12	6	4
Xylonite, 12-inch .. .. .	6	4	2
Rangefinders, " Leitz " 40-cm. .. .. .	2	2	—
Rulers, parallel, rolling, brass—			
12-inch .. .. .	2	1	1
18-inch .. .. .	2	2	1
24-inch .. .. .	1	1	1
36-inch .. .. .	1	1	1
Rules, slide .. .. .	2	1	1
Scales—			
Boxwood or ivory, 6 in a box .. .. .	1	1	—
Metal, 36-inch to 48-inch .. .. .	1	1	1
" 48 " " 60-inch .. .. .	1	1	—
" 60 " " and above .. .. .	1	1	1
Sextants—			
Observing, 8-inch .. .. .	2	1	—
" " " : stands for .. .. .	1	—	—
Pocket, 3-inch .. .. .	2	1	—
Sounding, 6-inch .. .. .	12	9	4
Stellar, .. .. .	4	1	—
Station pointers—			
6-inch .. .. .	10	6	3
8 " .. .. .	2	2	2
12 " .. .. .	1	1	—
6 " x 8-inch " Cust " .. .. .	10	6	3
12 " x 12 " " " .. .. .	6	4	2
Staves, levelling .. .. .	2	1	1
Straight edges—			
24-inch to 30-inch .. .. .	2	2	2
36 " .. .. .	3	2	1
48 " " 50 " .. .. .	1	1	1
54 " " 60 " .. .. .	2	1	1
72 " .. .. .	1	1	1
Tables, plane, with legs and alidade .. .. .	1	—	—
Tapes, measuring—			
Linen, 50-feet or 100-feet .. .. .	6	3	2
Steel, 100-feet—			
Ordinary .. .. .	2	1	—
Standard .. .. .	1	—	—
Springs for .. .. .	2	—	—
Thermometers for .. .. .	1	—	—

NORMAL ESTABLISHMENT OF HYDROGRAPHIC INSTRUMENTS—*contd.*

	Abroad.	Home.	S.C.E.
Theodolites—			
Precision ("Tavistock" model or micrometer reading)	6	4	1
Vernier (reading to 20 seconds or 1 minute)	3	2	2
Tools, boxes of, complete with blow-lamp, taps and dies	1	1	1
Umbrellas, tropical	6	—	—
Wireless receiver, Marconi type R.P. 11a, complete with valves	1	—	—
Frame aerial	1	—	—
Battery box	1	—	—
Valves, spare, for	12	—	—

**2. Repairs.**—Under ordinary conditions instruments supplied to H.M. Surveying Ships should not, with reasonable care, require repairs for a considerable time. Should this, however, become necessary, it is desirable that it should be arranged for repairs to be carried out in small quantities at short intervals, rather than large quantities at long intervals.

Thus, a certain number of instruments should be sent for repair and overhaul at the end of every surveying season.

Whenever hydrographic instruments are returned to the Hydrographic Department, as worn or damaged, they are to be accompanied by Form H.50, and, if necessary, a detailed report giving information as to how the damage occurred, and an opinion whether the instrument is worth repair. Similarly, when a surveying ship is finally paid off, a notation is to be made against all instruments in need of repair, and such as are considered not worth repairing. Usually, when a detachable part of an instrument requires repair it is desirable that the whole instrument be returned, but it is left to the judgment of the officer in charge of a survey not to take this too literally, since it may be that an instrument is in frequent use and cannot well be spared, and the part which needs repair may not be essential to all purposes to which the instrument can be put. It is unnecessary, for instance, to send home sextants, when all that is required is the re-silvering of the mirrors.

Storage batteries are supplied for use with certain instruments on first supply; when these batteries become worn-out they should be replaced by local purchase, any single cell storage battery being suitable; the Service pattern dry cells can also be used. Used batteries are not to be returned to the Department.

It is, generally speaking, advisable that hydrographic instruments should not be repaired out of England; minor repairs may, however, be performed by opticians or instrument makers of good repute on the station, though it is at times more satisfactory to carry these out on board the ship if a skilful fitter or electrical artificer is available. It is necessary in such cases to exercise careful supervision over the work done and the method employed.

**3. Demands.**—Instruments required in excess of establishments may be demanded at any time, and by signal, if the requirement is urgent. Brief reasons for making the demand are to be furnished. These instruments are to be returned as soon as they are no longer required. Separate demands are not normally required for instruments, of which the loss or return has been reported on Form H.50, but the fact that replacements are required is to be stated on the form.

If, however, the absence of instruments returned for repair is likely to lead to serious inconvenience in conducting surveying operations, a separate demand for the immediate replacement of such instruments as are absolutely necessary is to be forwarded.

Any list of requirements or replacements from ships abroad must be forwarded in ample time to allow of their supply by the date they are required, allowing two months for the Department to deal with the demand, in addition to the time necessary for their transmission.

**4. Losses.**—Losses by accident or damages to any of the more important instruments—i.e., those bearing H. numbers—are to be reported immediately to the Hydrographer on Form H.50. *All* cases of the loss of any instrument where either theft or negligence is suspected are to be reported immediately giving full particulars and details, in accordance with K.R. and A.1

Losses of hydrographic instruments are also always to be entered in the ship's log, and the date of such entry stated on Form H.50.

**5. Care of Instruments.**—Instruments are directly under the charge of the officer in charge of the Survey, the accounting and immediate supervision being relegated to the Senior Assistant Surveyor at the Commanding Officer's discretion. Certain instruments in constant use during a survey are allotted to each Assistant Surveyor for his particular use: these are usually sounding sextant, station pointer, and small box of drawing instruments, etc. The object of this is to familiarise him with a particular instrument, thus tending to the production of better work, and to ensure that instruments which are in frequent use are kept in a good and efficient state of repair and cleanliness.

The errors of each instrument allotted to an Assistant Surveyor or to a Recorder are to be at once ascertained by the person to whom it is allotted, and where applicable the corrections to be applied are to be noted in the lid of the box: this operation is to be repeated at frequent intervals.

Every instrument on return from daily service is to be wiped, and, if need be, partially washed with fresh water to remove the salt and keep it in good condition. This is to be done by the Surveyor using the instrument, or may, in the case of the less delicate ones, be deputed to a Recorder or the Chartroom Attendant; this does not, however, relieve the Surveyor from responsibility for any injury due to careless handling, etc.

Hydrographic instruments have sometimes been returned to the Hydrographic Department whose condition showed that but little care had been bestowed upon them by the Surveyors using them. As the accuracy of the work of a survey depends on the instruments used, it is essential that those supplied should be properly looked after, and every instrument is to be thoroughly examined by a senior Assistant Surveyor at least once a year.

Instruments are never to be placed in boats at the davits. When weather conditions are such that the accommodation ladder cannot be used, they are to be transferred to the boat in a strong canvas bag so arranged that it can be lowered or hoisted by a whip from a suitable davit. Precision instruments, theodolites, levels, etc., are to be carefully guarded against all risk of damage, and are never to be transported out of their boxes or in any manner which involves such risk.

**6. Xylonite protractors.**—The material used in the manufacture of "Xylonite" protractors, station pointers, etc., is very liable to distortion, especially if exposed to hot sun.

As errors in certain cases may amount to as much as 3 per cent., these instruments are not to be used, except for rough measurements, without careful checking before use.

In cases where the error is found to exceed 2 per cent., the instruments are to be returned to the Hydrographic Department for replacement.

**7. Musters.**—Whenever instruments are mustered on board, care is to be taken that the numbers on each instrument *and case* are checked, as well as the numbers on appropriate legs, stands, or other detachable parts. Care should also be taken that all instruments are returned to their proper cases when not in use.

**8. Instrument account.**—Hydrographic instruments are accounted for in the Instrument Account, Form H.77, which is rendered annually, and on the occasions of paying off (not recommissioning), and on the supersession of the officer in charge of survey.

Any instruments acquired by local purchase or loan are to be taken on charge in this account.

The instructions for keeping the account, given on the back of the form, are to be strictly adhered to.

Chronometers supplied for use with chronographs are not on charge in Instrument Account, but the name and number of the chronometer supplied with each chronograph is to be inserted in brackets after the relevant entry.

**9. Transmission and packing of instruments.**—Whenever instruments are returned to the Hydrographic Department for repair or for any other reason, they are always to be accompanied by Form H.50, and a reference sheet is to be sent under separate cover stating the mode of conveyance and route by which the package is being sent, and the expected date of its arrival, together with a list showing in detail the contents of the package. A list of contents is also to be placed inside the package, which is to be addressed "The Hydrographer, Admiralty, Whitehall, London," and also plainly marked "Instruments with Care."

Hydrographic instruments with the exception of those specially mentioned, are never to be packed for transit in cases exceeding 4 feet 6 inches by 2 feet 3 inches by 2 feet 3 inches. Instruments exceeding 4 feet 3 inches in length—viz., beam compasses, scales, straight edges, levelling staves, theodolite legs, etc.—are to be packed separately.

The lids of cases containing instruments are to be screwed and not nailed down.

The weight of any packing case containing hydrographic instruments is never to exceed 2 cwt.

When packing instruments for transmission, great care is necessary to have them firmly secured in their boxes, without being so wedged up as to cause injury by too much pressure on the more delicate parts. Sufficient space must be allowed between the instrument boxes and the packing case for a cushion of paper, wood shavings, etc. *Sawdust is not on any account to be used for this purpose*, as it invariably finds its way into the instrument boxes and causes much damage.

**10. Meteorological instruments.**—These are supplied as Naval Stores, in accordance with the Establishment of Naval Stores for Executive Purposes, and are to be accounted for in the ship's Naval Store Account.

Instructions regarding the supply and return of such instruments will be found in the "Naval Storekeeping Manual" (B.R.4).

Pilot balloon outfits are also supplied as necessary to H.M. Surveying Ships under the arrangements promulgated in A.F.O.

**11. Chronometers, watches, etc.**—Chronometers, chronometer watches, deck watches and pocket watches are supplied to H.M. Surveying Ships in accordance with the following establishment :—

Service.	Chronometers.	Chronometer Watches.	Deck Watches.	Pocket Watches.
Home .. ..	1	1	2	6
Foreign .. ..	3	3	2	10

They are not surveying instruments, and are on charge to the Navigating Officer.

The pocket watches supplied are of the Waltham or Willis type, other types being issued only in emergency.

Detailed instructions on the supply, use and treatment of these instruments are contained in Form H.112, which is supplied with all chronometer outfits.

A list of the chronometers and watches supplied, with particulars of their disposal, is to be kept in Form H.397.

So far as possible chronometers and watches returned from Surveying Ships on paying off or reducing to winter complement are re-issued to those ships on recommissioning or completing to full complement.

Chronometers fitted with electrical contacts and supplied for use with chronographs are also on charge to the Navigating Officer, although the chronographs are Hydrographic Instruments (*see also* § 8).

**12. Special surveying stores—supply.**—Special surveying stores comprise all stores and appliances, other than hydrographic instruments and stationery, which are specially supplied for surveying purposes, and are not kept as ordinary stores in H.M. Dockyards. A list of these stores is given on Form H.193.

They are supplied from the Hydrographic Store at Chatham by the Hydrographer's order, and all demands for such are to be made direct to him on Form H.193.

The original supply to a ship on first fitting out for surveying service will be made by order from the Hydrographic Department.

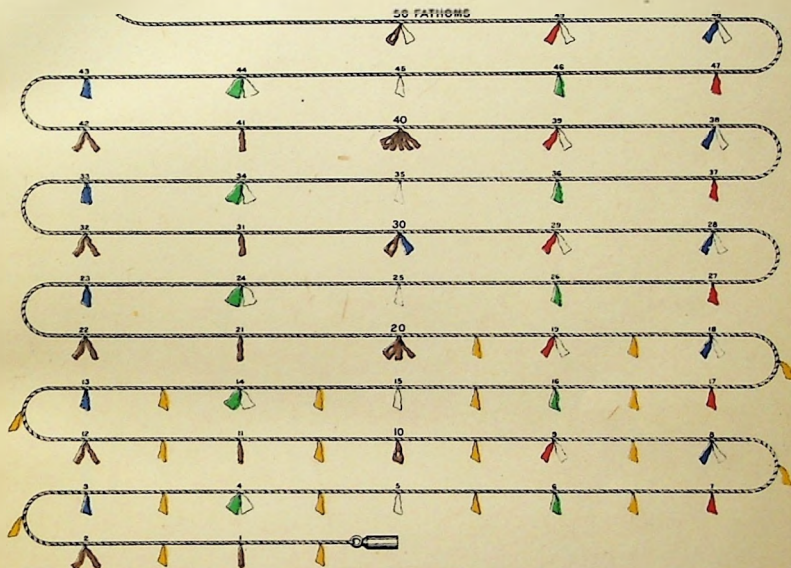
The stores are to be in the charge of the senior Assistant Surveyor and are to be accounted for by him.

No special surveying stores are to be supplied to any unauthorised person whatsoever, except under exceptional circumstances, when a special report with full details is to be made to the Hydrographer.

**13. Special surveying stores—accounts.**—The account of the receipt and expenditure of these stores is to be strictly kept in the form supplied—H.125—which is to be rendered to the Hydrographer annually, and on the occasions of paying off (not recommissioning) and the supersession of the officer in charge of the stores. It is to be accompanied by receipt and supply vouchers on the prescribed forms. Stores of a similar nature obtained by local purchase are also to be taken on charge in the account, and the entries supported by vouchers. Care must be taken to maintain the distinction between these special surveying stores and the additional ordinary stores on surveying service which are included in the establishments of naval stores.

Losses of special surveying stores are to be entered in the ship's log and dealt with in accordance with the "King's Regulations and Admiralty Instructions." Any special cases should be reported to the Hydrographer at once, stating the full circumstances.

## UNIFORM SYSTEM OF MARKING LEAD LINES



Lines (marked as above) to have in addition, one knot inserted at every 1, 2, 4 and 5 feet of each fathom: (for a sufficient length to ensure that, at least 65 feet (reduced) may be measured: eg given springs rise 25 feet, 25-65-90 feet, therefore line to be marked in feet to 15 fathoms.)

## UNIFORM SYSTEM OF CALLING SOUNDINGS

For that portion of the line which is marked, viz.	Soundings are to be called	
In fathoms and feet	To the nearest foot	"Five three, five two five one, five fathoms, four five, &c. &c."
In fathoms and half fathoms	To the nearest estimated half fathom	"Nineteen fathoms eighteen three, eighteen fathoms &c."
In fathoms only (20 to 50 fms.)	To the nearest estimated fathom	"Thirty fathoms thirty one fathoms, &c."

*Note.* The only exception to the above is that 9 and 11 fathoms are to be called "deep nine" and "deep eleven"; the word fathom being omitted, in order to distinguish them from 5 and 7 fathoms thus:— "Deep nine one, deep eleven, deep eleven three."

Prepared by the Hydrographic Dept. Admiralty 10<sup>th</sup> May 1932 under the Superintendence of Vice Admiral R. P. Douglas, C.B., C.M.G., Hydrographer  
Small corrections 1933 [216]

Misc. 60





**14. Precautions in securing and handling sounding machines.**—All sounding machines, whether in use on board the ship or in boats, in addition to being secured to their sounding platforms in the ordinary manner by their securing bolts, are also to be secured independently of the bolts by a piece of chain passed round the lower part of the frame and shackled to a bolt in the ship or boat, as the case may be. Before passing a sounding machine in or out of the ship or boat a rope's end is to be made fast to it, care being taken that the other end of the rope is secured.

**15. Defective sounding machines.**—Defective sounding machines are to be returned to the Hydrographic Store at Chatham Dockyard for repairs, and a detailed report forwarded to the Hydrographer stating the nature of the defects.

Ships refitting should arrange for any necessary repairs to be undertaken by the dockyard or by the ship's staff; it should not, as a rule, be beyond the capacity of the yard to refit a machine which has no serious structural defect, and it is as well to avoid, if possible, the delay and expense involved in sending these machines to England.

**16. Identification marks on beacons, etc.**—All Service material in use in connection with surveying marks, floating beacons and their moorings, tide poles, etc., which do not already bear any special service marks when received from a dockyard, are to be marked by the ship's artificers as far as possible in some manner to ensure ready identification in case of their improper removal, breaking adrift, etc.

**17. Preservation of sounding wire.**—The following precautions are to be observed in order to minimise the risk of the wire parting:—

- (a) After a long sounding cruise, with no prospect of the immediate use of the wire, the wire on the drum is to be condemned, so far as deep-sea work is concerned, but it may be conveniently utilised for the boat's machines in shallow-water work.
- (b) When the sounding machine is not in regular use the whole of the wire is to be occasionally reeled off on to one of the spare reels and dried carefully by running through oiled cloths, or cotton waste dipped in hot tallow, during the operation, replacing it on the drum of the machine and oiling it in so doing. The surface of the drum and any part which will come in contact with the wire when it is reeled on should first be well-dried and then freely coated with mineral grease before re-winding. This is invariably to be done at the end of every surveying season.
- (c) The wire on the drums of all sounding machines is always to be wrapped round with oiled cloths, and the machines well protected from the weather and salt or fresh water.
- (d) The wire is sometimes supplied in hermetically sealed cases but is more often in ordinary wood boxes. One splice only is allowed in 5,000 fathoms, and a report is to be made if more are found in this length. Such a length is not to be used, and if the wire carries away, leaving a splice in the portion on the drum, it must be unreeled to the splice, which is to be cut off and a new unbroken piece spliced on.

**18. Marking of lead lines.**—The uniform system of marking lead lines shown in diagram No. Misc. 60A (Plate No. 1) is to be adopted for use by ships and boats. Large copies of this diagram (Misc. 60) are supplied, for the information of Officers and Ships' Companies, and are to be exhibited framed in the Chartrooms and suitable positions on the Mess Decks.

**19. Surveying floating beacons.**—There are two main types of floating beacons used in the surveying service known, respectively, as the "Egeria Mark II" and "Ormonde" types.

The "Egeria" type was standardised in 1941, and all new beacons will normally be of this pattern.

The "Ormonde" beacon will become obsolete when supplies are exhausted.

A supply is held in store at Chatham, and these beacons may be demanded on Form H.193.

**20. "Egeria" Mark II Surveying Beacon—specification.**—The following is the specification of the "Egeria" Mark II Beacon (*see* Plate 2).

**CASKS.**—Two 40-gallon steel, standard Boom Defence Barrels, drawing No. B.D. 404; overall length, 2 feet 6 $\frac{3}{4}$  inches; length over chines, 2 feet 4 $\frac{3}{4}$  inches; diameter over bilges, 2 feet 1 $\frac{3}{4}$  inches; diameter over chines, 1 foot 9 inches.

**TOP AND BOTTOM PIECES.**—The casks to be secured top and bottom between two pieces of yellow pine, best quality. The top and bottom pieces to be checked down 1 inch over the chines of each cask.

The top and bottom pieces to be fastened together with six  $\frac{5}{8}$ -inch galvanised tie rods, nut and screw with saucer heads connecting the pieces together. The heads and nuts and ends of the tie rods to be let in flush for stowage.

Size of top and bottom pieces:—

Length, 5 feet 2 $\frac{1}{4}$  inches; width, 2 feet 4 inches; thickness, 4 inches (overlapping the casks entirely for protection).

A galvanised iron ring, 2 inches wide,  $\frac{1}{4}$ -inch thick, internal diameter 5 $\frac{1}{2}$  inches, to be secured with four brass, countersunk-headed screws to the extreme faces where the pole passes through the centre of the top and bottom pieces.

**BEACON POLES.**—Straight Norway spar, specially selected, free from knots and shakes; length, 35 feet; diameter at heel, 6 inches; diameter at upper sleeve, 5 inches, tapering to 4 inches at head.

A hole,  $\frac{3}{4}$ -inch diameter, to be pierced through the pole, 3 $\frac{1}{2}$  inches from the heel, with protecting washers to prevent chafe of shackle for heel weight.

Two galvanised iron sleeves, 12 inches long,  $\frac{1}{4}$ -inch thick, external diameter 5 $\frac{1}{2}$  inches, each secured to the pole by one brass countersunk screw; a  $\frac{3}{4}$ -inch hole to be pierced through the centre of each sleeve to prevent the pole slipping.

The hole through the upper sleeve to be 11 feet from the head of the pole, and the sleeves to be spaced 3 feet 0 $\frac{1}{2}$  inch between the holes.

The pole to be painted with two coats, best quality white lead paint above the upper pin hole, but the portion below this pin hole, also the barrels and top pieces, to be coated with best mineral tar applied hot.

**HEEL WEIGHTS.**—One 1 $\frac{3}{4}$ -cwt. and two  $\frac{1}{2}$ -cwt. sinkers secured by special "D" shackle through the heel of the pole.

**MAST.**—A bamboo of length about 35 feet is lashed to the part of the pole above the float. This carries a beacon flag of standard size (16 feet by 10 feet).

**RESERVE BUOYANCY.**—It has been calculated that the reserve buoyancy, when rigged and ballasted as above, is about 380 lbs.

**21. Beacon flags.**—The following is a list of beacon flags which are manufactured at Chatham Dockyard:—

Size: 16 feet by 10 feet.

All black.

Half red and half black (black on top).

Black and red horizontal stripes.

Black and red horizontal stripes with white stripe in centre.





Size : 8 feet by 4½ feet.

All black.

Black and red horizontal stripes.

Half black and half white.

Black and white horizontal stripes.

Red and white horizontal stripes.

Half red and half white.

**22. Oceanographical gear.**—All instruments, apparatus and gear supplied for the purpose of obtaining oceanographical observations are to be accounted for separately on Form H. 100 (Oceanographical Stores Account), which is to be rendered to the Hydrographer on the occasions specified in § 170.

All losses of oceanographical gear are to be reported to the Hydrographer in writing when they occur.

**23. Sweeping gear.**—It must be fully understood that the gear fitted is supplied as a "searching sweep" and it is not suitable for "skimming" or "bottom sweeping."

Once the obstruction, etc., has been located, the least depth over it must be ascertained by drift sweeping or other suitable means. Particular attention is drawn to the fact that the Depth Recorders are supplied for calibrating the gear on first issue, and thereafter for checking the depth if for any reason it is suspected that the depth keeping is faulty; and they are on no account to be used for sweeping on service.

**24. Uniform Survey Triangulation Mark.**—A supply is kept by the Naval Store Officer, Chatham, of permanent triangulation marks for the use of H.M. Surveying Ships.

The mark consists of a gunmetal disc and shank cast in one piece. The disc is four inches in diameter and has the following inscription cut in the metal:—

On an outer circle: "Hydrographic Department, Admiralty, London, S.W.1."

On an inner circle: "Triangulation Station, H.M.S."  
19 "

In the centre is a punch mark surrounded by an equilateral triangle. The shank is slit at the lower end to take a one-inch steel wedge, so that when driven into a drill hole it will bulge at the bottom and be securely held. The wedges will be supplied with the marks.

These marks are to be used to mark the position of recoverable main stations of a survey. They may be secured to drilled holes in rock, cemented into concrete blocks, or, in soft ground, secured to the end of a hollow iron tube, such as a boiler tube, the method varying according to the circumstances.

## SECTION II.

## BOOKS AND STATIONERY.

**25. Personal books.**—Each Assistant Surveyor is supplied with a Field Book (H.—7) for use in shore work—*e.g.*, coastlining, topography, etc.; Sounding and Sight Books (H.—13) for recording soundings taken from boats and astronomical observations taken on shore and at sea, and a Surveying Sketch Book (H.—12).

These books are to bear the appropriate titles outside, with the name of the Assistant Surveyor, the ship, the dates and the name of the station. Thus:—

“Challenger,” 1943-44.

Lieutenant A. B. Smith.

Field Book.

Mediterranean.

Various other books are supplied for recording data in connection with the survey; a list of these will be found in § 54.

**26. Special label.** (H.—44.)—This is to be pasted inside the front cover of every book containing surveying data before it is forwarded to the Hydrographic Department on completion of the survey. This is most important for future reference.

**27. Field Books, Sounding Books, etc.** (H.—7 and H.—13.)—All observations and notes are to be recorded in these books and the necessity for noting every fact of value cannot be too strongly insisted upon; nothing must be left to memory.

A date (day of the week, day of the month, month, and year) and the locality are to be inserted at the commencement of every day's work.

The guiding principle to be observed in writing up these books is that they should be intelligible to anybody with surveying experience. The importance of neatness cannot be too strongly emphasised.

The ordinary symbols should be used, as tending to brevity, but no others are to be employed without the sanction of the Officer in charge of the Survey.

The above-mentioned books are to be forwarded to the Hydrographic Department on the completion of the survey.

**28. Surveying Sketch Book.** (H.—12.)—This is to be kept in accordance with the instructions contained therein. It is to be noted that this book is retained by the officer to whom it is issued as long as he is in the Surveying Service.

**29. Main Angle Book.** (H.—157.)—This is to be kept in accordance with the instructions therein. All angles obtained at stations for the purposes of plotting main and other points are to be entered in this book. The final and accepted angle, where one or more are observed more than once, is to be carefully indicated.

When a false station has been made, the angles as observed, and the corrected angles, are to be shown in the separate columns provided.

A considerable saving in time will be achieved if all angles which are observed at a station are referred to the original zero used by the first observer: it is often vexatious when an angle is wanted in a hurry to find it necessary to go through one or more zeros to obtain it.

This book is of great service during the progress of a survey, and is to be forwarded to the Hydrographic Department on the completion of the survey, it being a most valuable record in connection with the work.



**30. The Deck Book.** (H.—85.)—This is to contain ship's soundings, angles obtained from the ship when used as a station, elevations of the land from ship's positions, and all other matter obtained from the ship herself, for which special books are not provided. It is to be forwarded to the Hydrographic Department on the completion of the survey.

**31. Deep Sea Sounding Books—rough** (H.—145) **and fair** (H.—144).—These are to contain the details of deep casts. Soundings are to be numbered consecutively during each year.

The fair book is to be forwarded to the Hydrographic Department on paying off, but the rough book is to be destroyed when finished with.

Loose forms, H.—37, are also supplied for transmission in duplicate to the Hydrographer as necessary (*see* § 99).

**32. Surveying Data Book.**—This is to be kept in an ordinary work book or a loose leaf file, and is to contain all the essential results obtained during the surveys on which ships are engaged.

The information entered in any Data Book is to be confined to one station only—i.e., "Home," "Mediterranean," etc.

No definite rule is laid down as to the quantity of material which can be usefully inserted in the Data Book, but the following details are considered desirable; others may be added as the Officer in charge of the survey considers necessary:—

- (a) *Geographical positions.*—A summary of results obtained with complete descriptions of observation spots and copies of any relevant correspondence.
- (b) *True bearings.*—Summary of results obtained and methods employed.
- (c) *Titles and memoirs.*—Copies of all titles and memoirs of all Fair Charts and important tracings.
- (d) *Variation.*—Copies of all returns.
- (e) *Tidal data.*—Full information *re* datums used and their connection to permanent marks ashore. Sites of all tide poles erected. Summarised results of the analysis of continuous observations of tides and tidal streams.
- (f) *Reports.*—Copies of reports of examinations, searches for shoals, etc.
- (g) *Hydrographic notes.*—Summaries of those which are directly concerned with the surveys.
- (h) *Sailing directions.*—Copies of amendments.

This book is to be sent to the Hydrographic Department on a ship paying off or being transferred to another station.

**33. Books of forms for calculating heights.**—Books containing 50 copies of G.S.G.S., form 19, are supplied for use in calculating heights. [The method of using this form is explained in the "Manual of Hydrographic Surveying."]

A ship's record of means of heights is to be kept in a convenient form during the course of a survey, and this record, together with the relevant forms, is to be preserved until the receipt of the Fair Chart in the Hydrographic Department has been acknowledged, when it may be destroyed.

Under normal circumstances the Fair Chart will be the only permanent record of heights.

**34. The Tide Journal.** (H.—143.)—This is to be kept in the form supplied, and in accordance with the instructions therein. It is to be returned to the Hydrographic Department with the next Fair Charts after it is completely filled, and on paying off if not recommissioning.

THE TIDE JOURNAL (H.—143A) is to be kept in the form supplied and in accordance with the instructions in H.—143. It is to be returned to the Hydrographic Department annually with the Fair Charts, and at other times when necessary.

**35. The Form for Computing Tidal Differences, Ratios and Non-Harmonic Constants.** (H.—15.)—This form is to be rendered with forms for Harmonic Analysis H.—217, 217A and 217B. Non-Harmonic Constants need no longer be computed, but the ratios and differences are required for Admiralty Tide Tables, Part II. The Standard Port to be used should be that to which places in the vicinity are referred in Admiralty Tide Tables, Part II. When tidal differences, etc., are to be computed the tides at the places are to be entered from the Tide Journal; observed tides at the Standard port should be entered if obtainable, otherwise the predicted tides from Part I of the Tide Tables. All necessary information relating to time used, chart datum, zero of the observations, etc., is also to be entered in the space provided. The differences, etc., are to be computed in accordance with the instructions in Part III of the Tide Tables, and the form, with the computations, forwarded to the Hydrographic Department with the Fair Chart of the locality (*see* § 76).

**36. The Forms for Harmonic Analysis.** (H.—217 and H.—217A, B and C.)—H.—217A is to be filled in from the Tide Journal when harmonic constants are to be computed. All information regarding time used, datum, etc., is to be given in the place provided in form H.—217. The harmonic constants are to be computed, in the manner described in Part III of the Tide Tables, in forms H.—217 and H.—217B, and these forms and H.—217A are to be forwarded to the Hydrographic Department with the Fair Chart of the locality. Form H.—217C is to be destroyed on completion of the computations.

**37. Forms for Analysis by the Admiralty Method.** (H.—224A, B and C.)—The heights for analysis are to be entered in form H.—224A from the Tide Journal, and all necessary information regarding time used, chart datum, zero of the observations, etc., inserted in the space provided. The constants are to be computed in accordance with the instructions in Part III of the Tide Tables and forms H.—224A and B forwarded to the Hydrographic Department. Form H.—224C is to be destroyed on completion of the computations.

**38. The Tidal Diagram Book.** (H.—160.)—This is supplied for use when it is required to plot tidal diagrams, etc. It is to be destroyed when completely filled and no longer required.

**39. The Record of Tide Pole Readings.** (H.—148.)—This is supplied for recording tide pole readings as observed, and for transmitting such readings from the shore to the ship. It is to be kept in accordance with the instructions therein, and is to be destroyed when completely filled and no longer required.

**40. The Tidal Stream and Current Log** (H.—183) **and the Sub-Surface Current Log** (H.—185).—These are to contain the observations for direction and rate of the tidal stream and current, obtained from the ship or from boats at anchor. They are to be kept in accordance with the instructions therein and

are to be destroyed when completely filled and no longer required. All observations by current log, whether surface or sub-surface, are to be recorded in H.—183, and all observations by current meter in H.—185.

**41. The Tidal Stream and Current Journal (Fair)** (H.—182) and the **Sub-Surface Current Journal (Fair)** (H.—184).—These are to be kept in accordance with the instructions therein; they are to be forwarded to the Hydrographic Department with the next Fair Charts after they are completely filled, and on paying off if not recommissioning.

THE TIDAL STREAM AND CURRENT JOURNAL FORM (H.—182A) and the SUB-SURFACE CURRENT JOURNAL FORM (H.—184A) are to be kept in accordance with the instructions in H.—182 and H.—184, respectively. They are to be forwarded to the Hydrographic Department with the Fair Chart of the locality and at other times when necessary.

H.—182 and H.—182A are to be used for observations by current log, both surface and sub-surface; H.—184 and H.—184A for observations by current meter.

**42.—Orthography Book.**—It is convenient, in some surveys, to keep a foolscap book in which all native names of natural and other objects as obtained by the different surveyors are entered.

The difficulty of understanding natives, and the difference in clearness of pronunciation by the natives, together with the differences in appreciation of the sound by different Surveyors, often leads to very erroneous names being placed upon the chart; but if the various versions are collected together, the Officer in Charge of the Survey can compare the different names collected, and, if necessary, correct the orthography according to the Admiralty rules before they are finally accepted. This book being only intended for the convenience of the Officer in Charge of the Survey, is not to be forwarded to the Hydrographic Department.

**43. Meteorological Log.** (H.—243).—H.M. Surveying Ships on foreign service are to keep the Meteorological Log while on passage outside Home waters and also while on their surveying ground, unless in the immediate vicinity of a British Meteorological Station.

(ii) The information furnished is to be in accordance with the instructions contained in, or issued in connection with, the log, and is to be as complete as possible; autographic records (barograms, etc.), synoptic charts, upper air records, details of special phenomena observed, and any photographs taken, etc., being pasted in the logs in their appropriate places. The study of meteorology is an important duty of surveying officers, and this fact should be fully reflected in the observations inserted in the logs.

(iii) Surveying Ships employed in Home waters will not be required to keep this log unless an officer is borne who is shown in the Navy List as having qualified in meteorology, and then only when the ship is working in an area over 50 miles from the coast of the British Isles.

**44. Meteorological Office Daily Weather Report.**—The British Section of the Daily Weather Report issued by the Meteorological Office, Air Ministry, is supplied direct to Surveying Ships in Home waters, and is to be utilised to assist in the study of meteorology and, where applicable, compared with the work plotted on the meteorological working chart appropriate for the area.

**45. Hydrographic Books for Reference.**—Books for professional reference are supplied from the Hydrographic Department in accordance with the establishment of the "Surveying Library" in § 46; this will be amended as necessary from time to time by means of "Surveying Ship's Orders."

Books in addition to this establishment will be supplied to individual ships if they are required in connection with the particular work on which the ship is engaged, and are not appropriate for general distribution. Such books are to be taken on charge as additions to establishment, and are to be included in the returns on form H.—97 rendered in accordance with § 47.

A personal copy of the "Manual of Hydrographic Surveying" and of the "General Instructions for Hydrographic Surveyors" will be supplied to each Surveying Assistant on joining. Replacements may be obtained on repayment.

The following periodicals are supplied for the information of Surveying Officers, but are not required to be taken on charge:—

*International Hydrographic Bulletin* (every two months).

*The Empire Surveyors' Review* (quarterly).

**46. Surveying Library.**—The establishment of books in the Surveying Libraries of Surveying Ships and the South Coast of England Survey is as follows:—

#### ESTABLISHMENT OF SURVEYING LIBRARY.

	Foreign Ships.	Home Ships.	S.C.E. Survey
General Instructions for Hydrographic Surveyors, 1945 ..	6	4	3
Admiralty Manual of Hydrographic Surveying .. ..	6	4	3
Admiralty Manual of Tides .. ..	4	2	1
Admiralty Navigation Manual, 1938, Vol. III. . .	2	1	1
Inman's Nautical Tables. . .	2	1	1
Manual of Spherical and Practical Astronomy (Chauvenet) (2 vols.) ..	1	1	—
Hints to Travellers, Vol. I and Vol. II .. ..	1	1	—
Textbook of Topographical Surveying (Close) .. ..	2	2	—
Survey Computations, 1932 (Ordnance Survey) ..	1	1	1
Founders of Oceanography (Hardman) .. ..	1	1	—
Handbook of Instructions to Collectors—British Museum (Natural History) ..	1	1	—
Nature Notes for Ocean Voyages (Carpenter and Wilson Barker) .. ..	1	1	—
Practical Optics (Johnson) .. ..	1	1	—
Geology for Beginners (Watts) .. ..	1	1	—
Science of the Sea (Fowler & Allen) .. ..	1	1	—
Cassels 7-Figure Logs .. ..	3	2	2
Logarithms of Sines and Tangents to every Second (Shortrede)	3	2	2
Tables used in the construction of Charts .. ..	3	2	1
Tables for facilitating the Calculation of Heights (Purey Cust) (large) ..	2	2	1
Tables for facilitating the Calculation of Heights (Purey Cust) (small) ..	7	5	2
Five-figure Log and Other Tables (Castle) .. ..	3	2	2
Chambers Seven-figure Mathematical Tables .. ..	3	2	2
Alphabets of Foreign Languages (Gleichen) .. ..	1	—	—
Tables of the Velocity of Sound, etc. (H.D. 282) ..	2	2	—
Instructions for Rigging and Handling Motor Boats Mark VI Surveying Sweep ..	1	1	1
Apparent Places Fundamental Stars .. ..	1	—	—
Surveying for Minelaying Operations (H.D. 377) ..	1	1	—
Instructions regarding Insulating Water Bottles (H.D. 307)	1	1	—
Instructions for Use of Ekman Current Meter (H.D. 315) ..	1	1	1
How the British Admiralty Charts are Produced (Hayes) ..	1	1	—
Instructions for Field Work (U.S. C. & G.) .. ..	1	1	—
Index of 800 Stars (Somerville) .. ..	1	—	—
Notes on Minor Trig. (Ordnance Survey) .. ..	1	1	1

	Foreign Ships.	Home Ships.	S.C.E. Survey.
*Triangulation Data—Specimen Copy .. .. .	1	1	1
The Prediction and Reduction of Occultations .. .. .	1	1	1
*Pamphlet on the Main Characteristics of Sea Water .. .. .	1	1	—
*Ordnance Survey Sheet Line Co-ordinate Data and Suppt. (H.D. 364) .. .. .	2	2	2
*Notes on the Standard (Unabridged) Nautical Almanac (H.D. 365) .. .. .	2	2	—
An Introduction to Charts and their Use (Hayes & Chriss) .. .. .	1	1	—
Air Photography Applied to Surveying (Hart) .. .. .	1	1	—

\* These publications are to be kept in the special folder provided.

**47. Return of Books.**—The Return of Books on form H.—97, which is to be rendered annually on 31st December, and on the occasion of paying off, is to consist of a certificate that the Surveying Library is correct in accordance with the establishment in §46, together with a nominal list of Hydrographic Books of Reference held in excess of establishment as specified in §45.

**48. Books lent from Admiralty Library.**—Certain books of voyages and on other subjects are lent for the use of surveying ships from the Admiralty Library. These bear the Admiralty Library Stamp, and are to be specially taken care of and returned to the Hydrographic Department when no longer required on board. A return on form H.—97 is to be rendered to the Hydrographer annually on the 31st December, and on paying off, showing the books that are on board. This return is to be separate from that referred to in §47.

**49. Original Documents.**—This name is given to various charts, maps, plans, triangulation schemes, etc., which have been received in the Hydrographic Department from the earliest times of hydrography, and in many cases, being the only copies in existence, are of very great value.

A return is to be made to the Hydrographer annually in December of all original documents belonging to the Hydrographic Department on board the ship, the number and title being stated.

All such documents are to be returned to the Hydrographic Department when no longer required, and must not be retained indefinitely.

The greatest care is to be taken of all original documents lent from the Hydrographic Department, and special attention is to be paid to their preservation. They are on no account to be bent when being used, as by so doing the paper may become broken; no document is to be folded, but is either to be kept flat or rolled loosely. As few remarks as possible are to be made on the documents, and then only in soft pencil, so that the danger of defacement by cleaning may be avoided.

Should any document become accidentally damaged, no attempt to repair it is to be made, but on returning it the circumstances that caused the damage are to be stated. The document will be properly repaired after return to the Hydrographic Department.

No additions or amendments are to be made to any of these documents without the Hydrographer's special sanction or direction, and any additions or alterations so sanctioned must be made clearly distinguishable from the original work by the use of coloured inks, and the nature, authority, and date of such amendments noted on the sheet near the title.

**50. Transmission of Fair Charts, Original Documents and other Matter connected with the Survey.**—Whenever Fair Charts or original documents, etc., are transmitted to the Hydrographic Department from H.M. Surveying Ships on Foreign Stations, it is first to be ascertained whether there is any channel of conveyance free of cost to the Admiralty; if not, the packages should either be handed to a Naval Store Officer, or Navy Agent, for despatch by the safest route, or else sent by registered post. Fair Charts are always to be sent by cabin freight.

Similar documents from Surveying Ships in Home waters should be either despatched by registered post or passenger train, or else conveyed by hand.

The greatest care must be taken to pack documents so as to minimise the risk of damage in transit, and rolls exceeding a length of 3 feet 6 inches are never to be sent through the post.

Packages are to be addressed to The Hydrographer, Admiralty, Whitehall, London, S.W.1, and lists are to be forwarded separately showing in detail the contents of each package, together with details as to the mode of conveyance, route, and the expected date of delivery. A list of contents is also to be placed inside each package.

**51. Stationery.**—(a) The following is a list of articles normally supplied for the use of Hydrographic Surveys. No hard and fast rule can be laid down as to the requirements of individual surveys, and officers are therefore not debarred from demanding articles, not in this list, which may be required in special circumstances, but normally all requirements should be found within this list.

Many of the articles are expensive, and care is therefore to be taken to restrict demands to requirements and to avoid all wastage in the use of the articles. It should also be borne in mind that this stationery is supplied strictly in connection with surveying work, and should be expended only for that purpose.

(b) The list of articles is divided into three sections, viz. :—

(A) Articles stocked in the Hydrographic Department ;

(B) Articles stocked in H.M. Stationery Office ;

(c) Articles which have to be specially purchased by H.M. Stationery Office.

Against each item in Section (B) the recognised code number is shown to facilitate reference, and these code numbers should be quoted in demands, and all articles in all three sections should appear on demands in the same order as in the list.

(c) Paper should be demanded in terms of sheets not in "packets." A packet usually contains 500 sheets. Other items should be demanded in terms of the quantities quoted in the list.

When drawing paper, which is liable to be damaged in a damp climate, is demanded, it is to be stated how much of it, not required for immediate use, should be hermetically sealed.

(d) It should be noted that Kodatrace is inflammable, despite the description on the wrapper, but impervious to damp. It has some liability to tear and to distortion in a change of temperature.

The matt side should always be used, and will be found a good surface for pen or pencil work.

Demands are to be rendered annually so as to reach the Hydrographic Department three months before the surveying season is due to commence in the case of supplies which will require to be consigned to addresses abroad, or six weeks in cases where supplies are due to be made to addresses in Home waters. Supplementary demands may also be rendered, if necessary, for stationery, etc., required for the drawing of Fair Charts.

## (A) LIST OF ARTICLES STOCKED BY HYDROGRAPHIC DEPARTMENT (EXCLUDING H. BOOKS AND FORMS).

Books, Entry (or Work), 300 pages, white foolscap, ruled 33 lines.

- \*Envelopes, thick, buff, No. 1 ( $9\frac{1}{2} \times 4\frac{1}{2}$  ins.) } Addressed: Hydrographer,  
 " " No. 2 ( $8\frac{1}{2} \times 3\frac{1}{2}$  ins.) } stamped "Official Paid."  
 Paper, calculating (squared in faint lines).  
 " special for rendering triangulation data.  
 Paper, squared (chart, thin or tracing) (see § 57).  
 \*Wrappers, Book Post, 12 x 8 ins., white. } Addressed: Hydrographer,  
 " " 16 x 10 ins., pale } stamped "Official Paid."  
 " " yellow }

## (B) LIST OF ARTICLES STOCKED BY H.M. STATIONERY OFFICE.

Code No.	Description.
1-21	Blotting paper, pink ( $22\frac{1}{2} \times 17\frac{1}{2}$ ins.).
1-32	" " white ( $17 \times 13\frac{1}{2}$ ins.).
2-14	Carbon, type, black, standard weight ( $13 \times 8$ ins.).
2-13	" " " ( $9\frac{1}{2} \times 7\frac{1}{2}$ ins.).
2-24	" " light " weight " ( $13 \times 8$ ins.).
2-23	" " " ( $9\frac{1}{2} \times 7\frac{1}{2}$ ins.).
4-22	Drawing cartridge paper, rolls, 54 ins. wide, 12 yds. long.
11-22	Slips, small, buff ( $8 \times 3\frac{1}{2}$ ins.).
15-13	Typewriting paper, thick, "A" ( $9\frac{1}{2} \times 7\frac{1}{2}$ ins.).
15-15	" " " ( $13 \times 8$ ins.).
15-33	" " thin, "C" ( $9\frac{1}{2} \times 7\frac{1}{2}$ ins.).
15-35	" " " ( $13 \times 8$ ins.).
17-21	Wrapping paper, Cap. Imperial ( $29 \times 22\frac{1}{2}$ ins.).
17-63	" " Lumberhand ( $22\frac{1}{2} \times 19$ ins.).
17-64	" " Smallhand, double ( $30 \times 19$ ins.).
18-11	Writing paper, foolscap, $\frac{1}{2}$ -sheets, buff.
18-32	" " cream laid R.A.
18-34	" " ruled 34 lines, R.A.
18-35	" " " 53 lines, R.A.
18-42	" " $\frac{1}{2}$ -sheets, cream laid, R.A.
18-45	" " " ruled 53 lines, R.A.
18-52	" " demy 4to, cream wove, R.A.
18-62	" " 8vo., fly, cream wove, R.A.
22-33	Envelopes, buff, No. 4 ( $5\frac{1}{4} \times 3\frac{1}{2}$ ins.), printed O.H.M.S. and gummed.
22-79	" " No. 2 ( $8\frac{1}{4} \times 3\frac{1}{2}$ ins.), printed O.H.M.S. and gummed.
22-84	" " No. 1 ( $9\frac{1}{2} \times 4\frac{1}{2}$ ins.), printed O.H.M.S. and gummed.
28-76	Books, Memo., octavo, ruled faint (S.O. 136 $\frac{1}{2}$ ).
28-77	" (90 leaves), octavo, ruled faint (S.O. 137).

## Colours, Cakes of, viz. :—

33-11	Brown Madder.	33-34	Neutral Tint.
33-13	Burnt Sienna.	33-35	Payne's Grey.
33-14	Burnt Umber.	33-36	Pink.
33-15	Cadmium Deep Orange.	33-37	Prussian Blue.
33-16	Carmine.	33-38	" Green.
33-17	Chinese White.	33-39	Purple.

\* Envelopes and wrappers stamped "Official Paid," are to be kept under lock and key and any wastage is to be reported to the Hydrographic Department.



(B) LIST OF ARTICLES STOCKED BY H.M. STATIONERY OFFICE—*contd.*

<i>Code No.</i>	<i>Description.</i>
33-18	Cobalt Blue.
33-19	Crimson Lake.
33-21	Cyanine.
33-22	Egyptian Blue.
33-23	Emerald Green.
33-25	Gamboge.
33-26	Hooker's Green No. 2.
33-27	Indian Red.
33-28	" Yellow.
33-29	Indigo.
33-31	Iron Oxide.
33-32	Light Red.
33-33	Medium Chrome Yellow No. 2.
33-41	Queen's Green.
33-42	Raw Sienna.
33-43	" Umber.
33-44	Scarlet Lake.
33-45	Sepia.
33-46	Steel.
33-47	Stone.
33-48	Ultramarine.
33-49	Vandyke Brown.
33-51	Venetian Red.
33-53	Vermilion.
33-54	Veronese Green.
33-55	Yellow Ochre.
67-66	Colour Saucers, Nests of 6, 3-in. in diameter.
68-31	Drawing Pins, brass, large boxes of 50.
68-32	" " small boxes of 50.
67-32	Elastic Bands, $\frac{1}{2}$ -in., assorted.
39-12	Erasers, Rubber, Draughtsmen's.
39-15	" " ink and pencil.
39-16	" " typewriting, circular.
39-18	" gum.
41-11	Gum Arabic, in 2-oz., 4-oz., 8-oz., 1-lb. or 28-lb. boxes.
41-24	" liquid, gills, with brushes.

## Ink, Drawing, Waterproof, viz. :—

42-21	Black.	42-27	Dark Green.
42-22	Brick Red.	42-28	Light Green.
42-23	Brown.	42-29	Indigo.
42-24	Burnt Sienna.	42-31	Orange.
42-25	Carmine.	42-32	Prussian Blue.
42-26	Cobalt Blue.	42-33	Scarlet.
42-34	Sepia.	42-37	Violet.
42-35	Ultramarine.	42-38	White.
42-36	Vermilion.	42-39	Yellow.

NOTE.—For use in hot climates, inks by Winsor and Newton should be demanded as in Section (c).

43-11	Ink, fountain pen, blue-black, 4-oz. bottles.
42-71	" Indian, in sticks.
43-62	" pints, blue-black.
43-64	" " blue-black record.
43-66	" " red.
44-11	" glasses, Crown (desk ink glasses).
44-22	Inkstands, No. 2, 10 x 7 in., open, with 2 glasses.
45-11	Knives, clasp.
45-12	" desk.
68-86	Ox Gall, in pots.
47-11	Paper fasteners, large
47-12	" " midget
47-13	" " small
47-14	" " wire

} 100 in box.

(B) LIST OF ARTICLES STOCKED BY H.M. STATIONERY OFFICE—*contd.*

<i>Code No.</i>	<i>Description.</i>
69-11	Paper weights, "A" covered with brown leather, without handle, $5\frac{1}{2} \times 2\frac{1}{2} \times \frac{7}{8}$ ins.
69-16	Paste, Office, in 10-oz. bottles, with brush.
48-11	Pencils, blue.
48-13	" green.
48-14	" red.
48-16	" yellow.

Pencils, drawing, in the following degrees :—

48-31	1st quality, B	48-36	1st quality, 2H.
48-32	" 2B.	48-37	" 3H.
48-33	" 3B.	48-38	" 4H.
48-35	" HB.	48-39	" 5H.
48-34	" H.	48-41	" 6H.
48-71	Pencils, Ordinary, R.		
48-75	" " HB.		
48-74	" " H.		
48-87	" for compasses, 3H.		
49-15	Penholders, Universal, improved.		

Pens, Steel, in packets of 10 and boxes of 100, unless otherwise stated :—

50-11	S.O. No. 1 F.	}	Mitchell's 0528 Stub and substitutes.
50-12	" 1 M.		
50-13	" 1 B.		
50-31	S.O. No. 5 F.	}	Mitchell's 0634 (Bronze Slip), Stub and substitutes.
50-32	" 5 M.		
50-33	" 5 B.		
50-46	" 8 F.	}	School, Bronze.
50-47	" 8 M.		
50-48	" 8 B.		
50-61	" 11 F.	}	J. Gilt.
50-62	" 11 M.		
50-63	" 11 B.		
50-72	Pens, Gillott's, No. 290, Lithographic. On cards of 10 ; pens, complete with penholders.		
50-73	" "	No. 659, Crow Quill. On cards of 10 ; pens complete with penholders.	
92-4805	Pens, steel, Mitchell's No. 0190, mapping. In packets of 12 and boxes of 1 gross.		
69-46	Pins, in 1-oz. packets.		
51-11	Punches, single, solid jaw, medium.		
54-11	Scissors, No. 1, 8 in. long.		
55-16	Sealing Wax, superfine red, 20 sticks to the lb.		
56-12	Sponges, No. 2.		
	Tape, white, ordinary (in pieces of 9 yards, 10 pieces in a packet) :—		
60-41	Broad, $\frac{1}{2}$ -in.		
60-42	Extra Broad, $\frac{3}{4}$ -in.		
60-43	Medium, $\frac{1}{2}$ -in.		
63-51	Typewriter Ribbons, Empire, No. 2, Black record.		
63-62	" "	Imperial, Black record, $\frac{1}{2}$ -in.	
63-63	" "	$\frac{1}{2}$ -in. for hot climates.	
63-59	" "	Black and Red record, $\frac{1}{2}$ -in.	

(c) ARTICLES WHICH HAVE TO BE SPECIALLY PURCHASED BY H.M.  
STATIONERY OFFICE.

Drawing Boards, Whatman's, hot pressed, 30 in. × 21 in.

Cloth tracing, "Alliance," Dull Back, continuous, 30-in. wide, No. 5.

" " " " 43-in. " "

Kodatracer, rolls.

Paper, Drawing, \*Antiquarian, H.P. (53 × 31 ins.), Whatman's No. 1, mounted on linen.

" " \*Antiquarian, H.P. (53 × 31 ins.), Whatman's No. 1, unmounted.

" " \*Double Elephant, H.P. (40 × 26½ ins.), Whatman's No. 6, mounted on linen.

" " \*Double Elephant, H.P. (40 × 26½ ins.), Whatman's No. 6, unmounted.

" " \*Atlas, H.P. (34 × 26 ins.), Whatman's No. 19, unmounted.

" " \*Continuous, mounted on linen, 6 ft. broad, 6 yds. long, Harding's No. 23.

" Tracing, Harding's, No. 498b, 30 ins. wide, continuous.

" " " " 40 ins. " "

" Tracing, Glacine.

" Transfer, red and blue.

(\* See sub-para. (c) of this paragraph regarding supplies required sealed.)

Sketch blocks, 12 × 9 ins., Smooth.

Brushes, for Water Colours :—

Sable, finest red in quills (No. 6 will be supplied if not otherwise specified).

Camel Hair :—

Small—Duck.

Medium—Extra Goose.

Large—Large Swan.

Wash Brushes, No. 12 size.

Flat, ½-in.

Sponge, Swan.

China, Round, Slant and Basin.

" Tile Palettes, six divisions.

Colour Boxes, filled with 16 following colours, whole cakes :—

Burnt Sienna.

Carmine.

Cobalt Blue.

Gamboge.

Hooker's Green, No. 2.

Indian Yellow.

Indigo.

Light Red.

Mars Orange.

Payne's Grey.

Prussian Blue.

" Green.

Raw Sienna.

Scarlet Lake.

Vermilion.

Yellow Ochre.

NOTE.—Refills to be demanded when required in section (b) with the exception of Mars Orange, which is not a stock item.



## 54. Lists of Books Supplied.

Number.	Title.	Establishment.	
		Foreign.	Home.
H.—7	Field Book (7½ inches × 4½ inches) .. .. .	24	18
H.—12	Surveying Sketch Book .. .. .	10	7
H.—13	Sounding or Sight Book (9½ inches × 6 inches) .. .. .	36	24
H.—58	Special binder for triangulation data .. .. .	12	6
H.—85	Deck Book .. .. .	12	12
H.—143	Tide Journal .. .. .	3	3
H.—143A	Tide Journal .. .. .	6	6
H.—144	Deep Sea Sounding Book (Fair) .. .. .	3	3
H.—145	Deep Sea Sounding Book (Rough) .. .. .	3	3
H.—148	Record of Tide Pole Readings .. .. .	12	12
H.—157	Main Angle Book .. .. .	3	3
H.—160	Tidal Diagram Book .. .. .	6	6
H.—182	Tidal Stream and Current Journal (Fair) .. .. .	3	3
H.—183	Tidal Stream and Current Log .. .. .	6	6
H.—184	Sub-surface Current Journal (Fair) .. .. .	2	2
H.—185	Sub-surface Current Log .. .. .	2	2
*H.—243	Meteorological Log .. .. .	—	—

## 55. List of Forms supplied.

Number.	Title.	Establishment.	
		Foreign.	Home.
H.—1	Qualifications of Surveying Recorders .. .. .	12	12
H.—15	For computing Tidal Differences Ratios and Non-Harmonic Constants .. .. .	12	12
H.—19	Qualifications of Assistant Surveyors below grade of First Class .. .. .	24	24
H.—37	List of Deep Sea Soundings and Serial Temperatures .. .. .	12	12
H.—44	Special label for pasting inside cover of books containing Surveying Data .. .. .	50	50
H.—50	List of Instruments Lost, Returned to Hydrographic Department or surveyed by Ships' Officers .. .. .	24	24
H.—56	Surveying Contingent Account (Cash) .. .. .	24	24
H.—68	Return of Survey .. .. .	12	12
H.—77	Instrument Account .. .. .	12	12
H.—97	Return of Books .. .. .	12	12
H.—99	Surveying Contingent Account .. .. .	12	12
H.—100	Oceanographical Stores Account .. .. .	12	—
H.—112	On the Supply, Use and Treatment of Chronometers, Chronometer Watches, Deck Watches and Pocket Watches .. .. .	1	1
H.—125	Special Surveying Stores Account .. .. .	12	12
H.—130	Requisition for Survey of Special Surveying Stores .. .. .	12	12
H.—159	Description of stations .. .. .	50	24
H.—182A	Tidal Stream and Current Journal Form .. .. .	12	12
H.—184A	Sub-surface Current Journal Form .. .. .	12	12
H.—193	Requisition for Special Surveying Stores .. .. .	Book	Book
H.—194	Return of Geographical Positions .. .. .	24	—
H.—204	Supply and Receipt Note for Special Surveying Stores (used only by Hydrographic Department) .. .. .	—	—

\* Supplied in the set of Meteorological and other Publications with chart outfit. Replenishments should be demanded from the Hydrographic Supplies Establishment, Creechbarrow House, Taunton Somerset.

55. List of Forms supplied—*continued*

Number	Title.	Establishment.	
		Foreign.	Home.
H.—217	Forms for Harmonic Analysis.. ..	12	12
H.—217A		12	12
H.—217B		12	12
H.—217C		12	12
*H.—224A	Forms for Analysis by the Admiralty Method ..	24	6
*H.—224B			
*H.—224C			
H.—408	Beach Gradient Diagram .. ..	100	50
H.—409	Adjustment of Triangulation, Form 1 .. ..	100	50
H.—409A	Adjustment of Triangulation, Form 1A .. ..	100	50
H.—409B	Adjustment of Triangulation, Form 1B .. ..	100	50
H.—410	Triangulation (Computation of Sides and Co-ordinates)	100	50
H.—411	Conversion of Co-ordinates (Rectangular into Geographical)	100	50
H.—412	Conversion of Co-ordinates (Geographical into Rectangular) ..	100	50
G.S.G.S.	Trigonometrical Heights.. ..	100	50
19			
—	Report on uncovering Trigonometrical Stations (Ordnance Survey Form) .. ..	—	24

56. The following forms in general use in H.M. Ships are to be obtained from the Hydrographic Supplies Establishment, Taunton :

H.387. Daily comparisons and errors of Chronometers, etc. (*see* § 11).

H.394. Supply or Receipt Certificate for Chronometers and Watches.

H.395. Hydrographic Note.

Form S.374A, Record of Observations for Deviation (to be used for observations for variation afloat (*see* § 95)), should be obtained from the Accountant Officer.

57. *Miscellaneous Diagrams.*—The following diagrams can be obtained on demand from the Hydrographic Supplies Establishment, Creechbarrow House, Taunton, Somerset. Attention is also drawn to the other diagrams, etc., in the 5,000 series shown in the Catalogue of Admiralty Charts, some of which are supplied with the complete set of Navigational Publications for use with chart folios.

Number.	Title.
Misc. 3A	Names and styles of lettering (complete alphabet).
Misc. 19	Standard patterns of borders, graduations, etc.
Misc. 26	False Station Corrector (Douglas).
Misc. 35	Squares, 5 divisions to an inch.†
Misc. 36	“ 8 “ “
Misc. 37	“ 10 “ “
Misc. 38	“ 12 “ “
Misc. 44	Subtended Angle Nomogram.
Misc. 59	Various comparative scales (Douglas).
Misc. 60	Uniform system of marking lead lines, etc. Large.
Misc. 60A	“ “ “ “ Small.
Misc. 217	False Station Curves for use in Beacon Triangulation.
5072	45° Astrolabe. Value of co-efficient “ A.”
5170	Diagram for preparation of star programmes for 45° Astrolabe.

\* Replenishments should be demanded from the Hydrographic Supplies Establishment Creechbarrow House, Taunton, Somerset.

† Supplied on chart, thin or tracing paper; lined faint red, green or blue. Type required should be specified.

## SECTION III.

## THE SURVEY.

**58. General remarks.**—How far the chart should be complete in all details must depend upon the nature of the work and the Hydrographic Instructions received. It is obvious that sketch, exploratory, coastal and large scale work require different treatment; the charting of the globe has, however, now so far advanced that, as a rule, a survey must be carried out in considerable detail; and it is only when work of a preliminary nature is being undertaken with, for instance, the object of examining an area prior to the detailed survey of some portion thereof, that open sounding and irregular methods of triangulation can be tolerated (*see* § 111).

The triangulation is the foundation on which all subsequent work depends, and no competent surveyor will permit this to be in error; even when the points are irregularly plotted by means of ships' stations, boats or beacons, they should still be as accurate as the ordinary needs of navigation require.

Detailed Sailing Directions are always to be rendered with the results of Surveys. Attention is directed to the instructions contained in the "Manual of Hydrographic Surveying." The survey limits, defined in instructions, must not be too strictly adhered to in cases where new work differs considerably from the existing chart, and the general principle to be observed is that sounding should continue until approximate agreement is reached. Officers in Charge of Surveys must exercise discretion in this connection, but large extensions of limits are never to be undertaken without first obtaining the approval of the Hydrographer (*see* § 112).

It is not infrequently the case that the surveyor in the field has exceptional opportunities for ascertaining the needs of surveying work in the locality or on the station on which he is serving, and it is an important part of the duty of the Officer in Charge to obtain and forward such information to the Hydrographer. Unless the need for a survey is urgent, in which case a special report should be forwarded immediately, it is sufficient to include such information on form H.68—Annual Return of Survey (*see* § 172).

Whenever possible, work asked for by the Commander-in-Chief, Senior Naval Officer, or local authorities, is to be undertaken, provided it does not seriously interfere with orders already given, but any extensive piece of work is not to be commenced without the Hydrographer's approval having been obtained.

Where a major survey is to be undertaken, consideration should be given at the outset to whether the time and cost of surveying or revising topography on the ground will be shortened or saved by doing this from air photography.

**59. Prompt notice of new dangers.**—When new dangers or details of immediate navigational importance are revealed during surveying operations, a report is to be made immediately by signal to the Admiralty and Commander-in-Chief, being repeated as necessary to local Naval and Harbour Authorities. Such signals are to be confirmed later by a Hydrographic Note (H.395), accompanied by a tracing when necessary. Except in special circumstances tracings are only required in original.

Other navigational information of importance to existing Admiralty charts and publications is to be rendered on Hydrographic Notes (H.395) as convenient, and in advance of the Fair Charts and Sailing Directions, if, as in the case of foreign stations, the despatch of the latter is likely to be delayed.



**60. Triangulation.**—The greatest care must always be taken in observing the angles of the main triangulation and precision theodolites are invariably to be used. Under normal circumstances, triangular errors of more than fifteen seconds should not be accepted.

Triangulations are always to be balanced by the methods given in the "Manual of Hydrographic Surveying."

The Ordnance Survey triangulation is invariably used for surveys in the British Islands, and similar triangulations exist in many of the Colonies, and should be similarly employed if obtainable.

Even if such triangulations are not entirely suitable or adequate for the survey in hand, the new triangulation should, whenever possible, be connected to existing work, and co-ordinated on the same point of origin.

When existing triangulation, other than the Ordnance Survey, is employed, it is essential to ascertain to which projection and origin the rectangular co-ordinates are related, and whose figure of the earth has been used in their computation, *e.g.*, rectangular co-ordinates supplied by the Survey of Egypt are dimensional measurements on the Gauss Conformal (Transverse Mercator) Projection.

The origin is in Latitude  $30^{\circ}$  N., Longitude  $31^{\circ}$  E., or Latitude  $30^{\circ}$  N., Longitude  $27^{\circ}$  E., according to whether the area affected is East or West of Longitude  $29^{\circ}$  E.

Helmert's figure of the earth (Compression  $1/298.3$ ) is used in computations.

When calculating Geodetic Positions through triangulation in the British Islands, Airy's figure of the earth is always to be used in order to conform with the practice of the Ordnance Survey.

Clarke's first figure is to be used for all such calculations outside of the British Islands unless the triangulation is based on a local land survey which adopts some other figure, in which case local practice must be conformed with.

In calculating Geodetic Positions from co-ordinates supplied by the Ordnance Survey, the formula for the transformation of co-ordinates given in the "Manual of Hydrographic Surveying" should be used pending further instructions.

**61. Rendering of Triangulation Data.**—Triangulations are to be rendered in typescript on one side only of the special paper provided, the typed pages being bound in the binder (H.58) supplied.

They are preserved as Original Documents in the Hydrographic Department, and care must be taken to avoid alterations and erasures and that every figure and letter is legible and of even thickness.

A typewriter with two-colour ribbon (red and black) is supplied to all Surveying Ships for use in this connection; if any other colours are required they are to be put in by hand printing.

The data required are comprised of a diagram and nine sections which are to be assembled in the binder in accordance with the following list, the whole being duplicated, and one copy retained on board with Ship's records.

The General Locality, Title of Survey, Name of Ship and Year is to be typed at the top of every sheet of typescript.

**DIAGRAM OF TRIANGULATION.**—To be drawn on tracing cloth on a convenient scale and placed in pocket provided. The rough coastline to be indicated and landwork tinted, and a scale and meridian inserted. Ordnance or Land Survey Trig Stations are to be shown in green, floating marks in blue, and all others in red. Main Trig Stations are to be indicated by a circle surrounding a triangle; other stations without triangles. All stations are

to be lettered, and the triangles to be numbered in accordance with list in section 3 of the data. The various polygons and quadrilaterals involved in balancing are to be indicated as far as possible by different colours and numbered with Roman numerals.

If the co-ordinates of any secondary stations have been determined by the semi-graphic method, the "rays" to such stations are to be indicated on the tracing by pecked lines, and a large-scale diagram of each actual "plot" is to accompany the data.

**SECTION 1. LIST OF RECTANGULAR CO-ORDINATES.**—Stations to be listed in the alphabetical order of their distinguishing letters. List to be in tabular form with full names of all stations, and to include the Point of Origin, the geographical co-ordinates of which are to be stated. Any secondary stations necessary are to be included in a separate list following the main stations.

Everything in connection with data accepted from previous surveys is to be shown in green in this and all other sections.

**SECTION 2. DESCRIPTION OF TRIANGULATION.**—To consist of a short but comprehensive description of the methods employed in the adjustment of the triangulation with a list of the various figures in the order of balancing.

The description should state clearly what, if any, data is accepted from previous surveys.

**SECTION 3. LIST OF OBSERVED AND ADJUSTED ANGLES.**—The triangles to be numbered in the order of computation, and the following information tabulated, viz. :—

Observed Angle, Adjusted Angle, Sine of Adjusted Angle. "Calculated" Angles are to be shown in red, and angles accepted from previous surveys in green; all others in black.

When both theodolite and sextant angles are included, they must be differentiated in some convenient manner.

A tabular statement of the Adjusted figures, which are to be distinguished by Roman Numerals, together with their component triangles, is to be given underneath the columns: here also triangles accepted from previous survey are to be shown in green, whilst triangles adjusted in previous polygons are to be shown in red.

**SECTION 4. LIST OF SIDES.**—A tabulated list of alphabetical order of the lengths of all sides in feet with their logarithms. Sides derived from previous surveys in green as before.

**SECTION 5. BASE MEASUREMENTS.**—Full details of all measurements and description of methods employed. Details of corrections applied—that is, temperature, slope, comparison with standard tape, etc. Diagram of base triangulation with list of triangles, etc., and description of adjustment.

**SECTION 6. LIST OF GEOGRAPHICAL CO-ORDINATES.**—To include only *recoverable* stations and newly-co-ordinated natural objects. It is essential that the position on which these co-ordinates depend should be clearly stated. If depending on own observations, a reference to the relevant return is to be made. The "constants" used in making the calculations are invariably to be stated.

**SECTION 7. APPENDIX OF PROBABLE ERRORS.**—To include Probable Errors of Observations for Geographical Positions, as found on form H.194. Average triangular error, and the number of sets and range of any observations for Azimuth.

**SECTION 8. DESCRIPTIONS OF STATIONS.**—To be inserted on form H.159. Description must be as definite as possible, with diagrams giving measurements and transits to aid identification whenever possible. When stations are made at masts, measurements must always be given to corners, or other parts, of buildings in the vicinity. These forms are only to be inserted for stations which are recoverable.

**SECTION 9. INDEX.**—The Index should state the number of pages comprised by each section.

**62. Surveys based on ordnance triangulation.**—When a survey is based on Ordnance Survey data, which is usually contained in original documents supplied by the Hydrographic Department, Triangulation data need not be rendered in the comprehensive form detailed in § 61.

It is essential, however, that details of the useful and recoverable Ordnance Stations in the area covered by the survey, together with those of new stations made or natural objects co-ordinated, should be assembled and rendered in the established form (*see* § 61, sections 1, 6, 8 and 9).

Cross references to the previously-existing Original Documents should be included as necessary, and a reference to the documents included in the Memoir of the Fair Chart.

If, however, owing to failure to recover a sufficient number of Ordnance Trigonometrical stations, the survey is actually based on what amounts to a separate triangulation, full details must be rendered in the established form.

Whenever a search for an Ordnance Trigonometrical station is made it should be noted in the Original Document concerned whether it was recovered or not, and the date. Revised descriptions of the stations should be inserted where necessary (*see also* § 194).

**63. Surveys from Air Photographs.**—Where air photographs have been used for the insertion or amendment of topography, the following records are required in the Department :—

- (a) One complete set of the photographs used, with control points pricked and clearly indicated on the backs of the photographs.
- (b) The minor control plot tracings, and strip and block adjustment tracings, if any, with control points indicated.
- (c) Where single photographs have been used for the insertion or amendment of topography by the Four Point Method, the points selected should be pricked and clearly indicated on the backs of the photographs.
- (d) A brief description of the methods employed, with a statement indicating the accuracy obtained, and any recommendation that the photographs should be re-examined in the Department owing to lack of apparatus of sufficient precision on board or shortage of time, etc.
- (e) A description or shaded tracing to indicate the work inserted from this source.

**64. Plotting.**—The main triangulation stations are always to be plotted by the methods outlined in the "Manual of Hydrographic Surveying."

All field work, whether soundings, coastline, or topography, should normally be plotted on the spot. Conditions may sometimes render this impossible, but it is essential that the work should be plotted as soon as possible, whilst all the facts connected with it are fresh in the mind of the Surveyor.

**65. Soundings.**—The soundings are the most important part of a chart. Vessels of great size and value have to trust entirely to the charts to avoid dangers ; and a great responsibility rests upon the Surveyor in the present day. The loss or damage which may occur to a vessel by stranding on some danger not detected in the course of a survey must always be borne in mind. It is only by close sounding and rigorous examination of all irregularities of the bottom that any reasonable assurance can be felt of the completeness of the survey.

No soundings which can be legibly shown should ever be omitted from an original chart, nor are they to be eliminated with the object of improving the appearance of a chart : the selection of the soundings which are to appear on the published chart is the work of the Cartographers in the Hydrographic Department who prepare the work for the engravers.

In a detailed survey the usual practice is to run lines of soundings at right angles to the general direction of the coast, out to depths of 5 to 20 fathoms at a distance apart of two-tenths of an inch, whatever the scale may be ; consequently, the smaller the scale the less the thoroughness of the sounding, and also the greater the responsibility and difficulty of the surveyor to ensure that no dangers are missed.

The practicability should be noted of so handling a ship or boat fitted with echo sounding that a depth contour can be accurately fixed by running a line of soundings parallel to it. In application this may be of particular value when determining the limits of dredged channels, etc.

The least water on a bank may sometimes be determined by running a line of soundings *along* its axis, casting the boat from one side to another to keep in the shoalest water according to the previously-obtained echo record.

It is usually permissible to open out the distance apart of the lines of soundings as the depth increases, but this must necessarily depend on the general nature of the locality, and must be at the discretion of the Officer in charge of the survey.

Lines of soundings should also be opened out over shallow banks of large extent, and large areas of inshore shoal water which are impassable to anything except boats and small craft.

In unsurveyed localities or in places where little is known of the depth and nature of the sea bed, a study of the general trend of the contours revealed during preliminary work will often afford an indication of the best method of sounding out a particular area, and there is no desire to lay down a hard and fast rule that lines of soundings must necessarily be at right angles to the coast line.

Where irregularities of depth are found to exist, or where, from the rocky nature or formation of the coast, they may be expected to occur, the smallest indication of dangers must be thoroughly examined. On a small scale an arrow tongue of shoal ground, lying between two lines of soundings, may easily exist, either isolated or running off from a reef or point of land, even though the lines are as closely spaced as the scale will permit ; but a few cross lines will considerably diminish the risk of missing such a shoal.

Although the scale is the principal factor in revealing shoals, the fact remains that, generally speaking, it is seldom practicable to carry out coast surveys on a larger scale than about 2 inches to the mile ; the Surveyor must, however, make the most of the scale upon which he is working by interlining and cross-lining, as he considers necessary.

Particular attention must be paid to the soundings within the 10-fathom line, where the most rigorous examination is especially necessary.

A point to be borne in mind is that, in many cases, on a coast survey where anchorage exists, although the judgment of the Surveyor may be perfectly

sound, that a large scale plan is unnecessary, yet it may nevertheless be desirable to differentiate it from the surrounding work by running additional lines of soundings. In fact, any indentation in a coast which may lead a vessel close to the land for anchorage in time of necessity, or any promontory which might have a similar effect upon her course for passing or rounding it, must receive special attention, notwithstanding that it may not be necessary to make a large scale plan of it.

On any change of direction in lines of soundings special care must be taken to avoid leaving large, unexamined areas.

In counselling the necessity, however, for close lines of soundings and utilising the capacity of a given scale to its utmost by crossing the lines of soundings, and sweeping in certain cases, it is fully recognised that this means greater time spent over the examination of a given area, and, in consequence, an apparently smaller output of work.

When soundings are given in greater profusion in any area on a fair chart, they are sufficient indication that an examination has been made in the vicinity, but in all cases where new shoals or rocks are found, or where those previously charted are verified, found to carry less water, or proved non-existent, details including the least depth of water, the nature of the bottom, the position in relation to established points in the survey, and whether they have been swept over, are to be embodied in the sailing directions accompanying the chart (*see* § 165).

**66. Sweeping.**—No hard and fast rules can be laid down as regards the undertaking of sweeping operations, the necessity for which is frequently best judged by the man on the spot. Sweeping is the most positive method of disproving the existence of reported rocks and obstructions, or of ascertaining the least depth of water in an area; it must be remembered, however, that the least depth of water over a rock of known position is often best ascertained by sending down a diver.

Sweeping operations take up so much time that it is essential that they should not be undertaken indiscriminately, but should be confined to cases of vital importance in the interests of safe navigation. As a rule general Officers in Charge of Surveys should not undertake sweeping operations of any considerable magnitude without first obtaining the approval of the Hydrographer, but they should not hesitate to use this method of searching for rocks or obstructions of which the approximate position is either known or suspected.

Every advantage must be taken of the local knowledge of fishermen and others to ascertain the existence and position of pinnacle or other rocks.

In deciding whether sweeping operations are necessary it should be borne in mind that a depth of 36 feet is now a danger to large vessels in smooth water, whilst even 40 feet may be a danger with any scend of sea.

Full use should be made of Asdic equipment to locate Wrecks and Vigias. For instructions on rendering reports on sweeping operations, *see* § 127.

**67. Accuracy of soundings.**—It is by no means easy to fix with accuracy the position where a steep rise or fall of the sea bed occurs and, with the greater speed which echo sounding now makes possible, mistakes have occurred in plotting and spacing soundings.

Speed must be controlled in order to permit sufficient fixes while sounding, and care must be exercised in the selection and spacing of the soundings.

Fixes should not be too far apart, even when the depths are regular, and the more irregular the depths, or the quicker they vary, the closer should be the fixes. When this is not attended to the resulting contours are often at variance with the truth.

Care must be taken to ensure (i) the correct zero setting and speed of the echo sounding recorder ; (ii) the absolute reliability of each individual sounding called by the echo reader ; (iii) that the soundings so called are correctly entered in the book ; and (iv) that if any sounding, when entered, appears at all suspicious, it is immediately verified in order that no doubt may arise thereafter.

The best echo reader is bound, sooner or later, to call a false sounding which, if undetected at the time, may result in considerable loss of time in endeavouring to account for it afterwards.

When sounding by leadline, continual supervision of the leadsman is essential on all occasions to ensure the correct reading of the line, and also that no sounding is accepted unless the line is up and down.

The Surveyor should always endeavour to obtain actual fixes on or near the contour lines, which are indicated on the fair charts (*see* § 121).

Cross lines should occasionally be run in order to check the gradient of the sea bed, when the contours follow, more or less, the direction of the lines of soundings.

Errors in tidal reductions may be due to the tidal observations themselves being incorrectly recorded ; such inaccuracies can, however, usually be detected and corrected when the tide curve is plotted. Errors are more likely when the tide pole is at a distance from the area sounded, for there may be appreciable but unknown differences in the range of the tide and the times of high and low water in the sounding area and at the tide pole. When, owing to local conditions, the erection of a tide pole is impossible and the reductions are computed, error is inevitable ; if the range of the tide is great and the computed times of high and low water are incorrect by even half an hour, reduction may be several feet in error at half tide.

The effects of incorrect reductions are not only that the soundings themselves are incorrect, but that they are also relatively incorrect, and may give an entirely erroneous idea of the contours of the bottom. Further, depths shown by cross lines of soundings will not agree with those originally obtained, and it should be noted that the discrepancy between individual soundings in the same spot may amount to double the maximum error in the reductions.

Whenever it is practicable, therefore, a tide pole is to be erected in, or in the immediate vicinity of, the area where sounding is to take place, even if it can only be observed whilst sounding is actually in progress. From comparison of the observations so obtained with those at the principal tidal station, the correct datum may be ascertained and maintained and the accuracy of the reductions ensured. When possible, such temporary tide poles should be connected with permanent fixed marks on shore. Even if the erection of a tide pole is impossible, much useful information regarding the local tidal movement may be obtained from soundings, obtained at regular intervals, from a boat moored in a position where the bottom is known to be flat.

When sounding, the times when detached drying rocks are awash are to be noted and compared with the tide pole readings. If, at the times when any rock is awash, both on the rising and on the falling tide, and particularly if the rock is awash at about half-tide, the reductions are always the same, there is no doubt that correct reductions are being used ; if differences occur the reductions are incorrect. The heights on the tide pole at which certain selected and easily recognisable rocks are awash, together with a sufficient description to ensure correct identification, are to be inserted in the "Tide Journal" (H.143). Such entries may be extremely valuable in after years, if bench marks have disappeared and it is desirable to recover the datum.

**68. Correction of echo sounding.**—Echo sounding gear as fitted is calibrated for a velocity of sound in sea water of 4,960 feet per second. Slight variations of speeds of echo sounding machines must be expected and the actual speed should frequently be determined, inserted on the record, and the results used in calculating the correction to be applied. It is obvious that if the variation is great, far more error will be introduced in the sounding from this cause, if unnoticed, than from the incorrect use of the "Tables of the Velocity of Sound in Pure Water and Sea Water" (H.D.282).

The true velocity of sound in sea water varies, however, from the 4,960 feet mentioned above, in different parts of the world and in different depths and conditions, and the corrections necessary on account of such variations may be of considerable magnitude in deep water and by no means negligible in comparatively shallow depths. When recording echo machines are used and in order that sounding books may contain complete data, as with other methods of sounding, soundings in sufficient numbers are to be read off the records and inserted in the books, either at the time of sounding or at some later stage. The records may then be destroyed at the discretion of the Officer in Charge of the Survey.

**69. False Echoes.**—Cases have occurred in which incorrect soundings have been reported owing to false echoes. Such echoes may be caused by dense shoals of fish or layers of water which are differentiated by sudden changes of temperature or salinity or both. Echoes from shoals of fish should be distinguishable without much difficulty, as their character will probably differ considerably from ordinary bottom echoes, and the beginning and end of the shoal will hang in "mid air" on the record.

The reflecting power of a layer may, owing to its nearness to the surface, give as strong an indication as the bottom and, in most cases, the false echo can be distinguished by being several times as long as the outgoing signal. Sometimes, however, the reflecting layer may be thin, and will be indicated by a sharp echo.

When reflection takes place from a layer, it has been suggested that its true character can be more readily appreciated on the deep scale setting, and in cases of doubt a temporary change over to the deep setting should be made.

It should be noted that the bottom echo is, as a rule, only slightly blanketed by layers or shoals of fish, and it should be clearly visible on the record.

Surveying officers are warned to be on the lookout for such false echoes, and cases where they occur should be reported to the Hydrographer. Occasional checks with a leadline are the only satisfactory method of proving or disproving them.

**70. Reduction of Soundings.**—In reducing soundings the general principle to be observed is that soundings are never to be increased by more than one quarter of the unit employed.

It therefore follows that the tidal reduction changes to the next higher foot when the decimal of the height of tide above datum is 0.3—i.e., if tide is 3.3 feet above datum reduction is 4 feet. In the case of inserting the reduced soundings on the chart, the application of the same principle involves the omission of all fractions less than three-quarters of the unit—i.e., 19 fathoms, 4 feet = 19 fathoms; 19 fathoms, 5 feet = 20 fathoms.

Reduced soundings of less than one foot are to be considered as being awash.

**71. Uniform system of calling soundings.**—The Uniform System of calling soundings when a lead line is being used is given on diagram Misc. 60A (see 18 and Plate No. 1).

When non-recording Echo Sounding Gear is being used all soundings are to be called in fathoms and feet.

**72. Nature of the bottom in coast or harbour surveys.**—The nature of the bottom is to be carefully noted in the sounding book ; in many cases the specimens brought up by the lead is merely that of a thin surface layer, and in anchorages the material brought up on the flukes of anchors, whether of ship or boat, must be examined to get a better idea of the holding ground. Specimens should also be obtained from beacon anchors.

Echo sounding traces are not reliable indications of the nature of the bottom, since hard and steep-to sandbanks may give very similar traces to rocky formations.

**73. Datums and bench marks.**—Existing datums are never to be changed without reference to the Hydrographic Department. When it is necessary to establish a new datum, if there are established datums in the vicinity this is always done by the comparison of simultaneous tidal observations at the places where there are established datums and where the new datum is to be established. If there are no established datums in the vicinity, the new datum must be established independently by means of tidal observations, and is then to be at a level so low that the tide will but seldom fall below it (*see* § 74)

Datums are always to be referred to at least one—and when possible more than one—permanent fixed marks on shore. In Great Britain and other countries where a land survey datum exists, reference is always to be made to the land survey bench marks and datum. Such bench marks are, however, frequently on buildings liable to disappear or to be altered, and these references are, therefore, to be additional to, not in place of, references to permanent fixed marks. References are to be to the nearest 0·1 feet, except at places which are Standard ports in the Admiralty tide tables, or where there are docks, in which cases references should be to the nearest 0·01 foot.

Unless appreciable tidal changes occur, datum should be at the same level over the whole area of any port, harbour, etc. ; transfer from place to place should therefore be made through the land survey datum, where such datum exists. When there is no land survey datum, when tidal changes are known to occur, and in surveys of large areas, transfer of datum is to be made by means of simultaneous tidal observations.

Land survey (Ordnance) datums in Great Britain and Ireland are defined at table V in the Admiralty Tide Tables, Part I, Sect. A. In Great Britain, where change from the Liverpool to the Newlyn datum is in progress, a statement of the datum to which bench marks are referred will generally be found on the Ordnance sheets ; if no such statement appears reference is to the Liverpool datum. Difference between these datums may amount to nearly 2 feet ; it is therefore of great importance that the datum referred to should be stated, and all references to Ordnance datum, in Great Britain, whether on fair charts or in tide journals or in other books or forms, are invariably to be accompanied by the word " Liverpool " or " Newlyn," in brackets, according to the datum used.

**74. Establishment of a new datum.**—Chart datum, as accepted, at the International Hydrographic Conference, 1926, is to be " a plane so low that the tide will but seldom fall below it." This level, which is to be used for all new and independently established Admiralty chart datums, and in regions where the diurnal inequality is small, can be assumed to be half-way between mean low water springs and the lowest level to which the tide falls. If the constants for the place have been computed, datum from non-harmonic constants will be mean level—0·55 (mean spring range) and from harmonic constants will be



$A_0 = 1.1$  (H of  $M_2$  + H of  $S_2$ ). In such regions the non-harmonic constants are to be preferred as they allow for the shallow water effects.

Where the diurnal inequality is appreciable, that is when H of  $K_1$  + H of  $O_1$  is greater than 0.1 (H of  $M_2$  + H of  $S_2$ ), the datum is assumed to be Indian Spring low water which is defined in Admiralty Tide Tables, Part III, as  $A_0 = (\text{H of } M_2 + \text{H of } S_2 + \text{H of } K_1 + \text{H of } O_1)$ .

In such cases, the non-harmonic constants cannot be used to obtain datum.

Establishment of datum should always be deferred, if possible, till the harmonic constants have been computed. If this is impossible, datum must be established according to the following circumstances:—

- (a) The tidal observations available, from which mean level is to be computed.
- (b) The lowest low water which has been observed.
- (c) The lowest point to which it is probable that the tide will fall, according to the type of tide and the lowest tide predicted at Standard ports having tides of a similar type.

Datum should then be established at a level about 0.9 of the difference between mean level and the lowest tide expected, below mean level. It must, however, be recognised that a datum so established may prove unsatisfactory in practice.

**75. Transferring an established datum.**—There are now but few regions without established chart datums. It is of great importance that neighbouring datums should be so co-ordinated that a tide which falls to datum at one, falls also approximately to datum at all, even though such datum does not agree with the International datum. When, therefore, it is required to establish a new datum and there are established datums in the vicinity, when a newly established datum is to be transferred to another part of the survey outside the limits of the port, anchorage, etc., and when there is no land survey datum, transfer is to be by means of tidal observations, obtained simultaneously at the place where datum is known, and at that where it is to be established. For this purpose the following observations are required:—

(a) Where diurnal inequality is small: Not less than 4, and in any case an *even* number of, consecutive high waters, with the same number of consecutive low waters preceding or following them, the observations being obtained as nearly as possible at springs.

(b) Where diurnal inequality is appreciable: A minimum of 3 consecutive higher high waters, with the same number of lower low waters preceding or following them, the observations being obtained as nearly as possible at the time when the tide attains its greatest range.

Two days' observations, therefore, suffice when diurnal inequality is small, 3 days when this is appreciable.

From these observations, mean high (or higher high) water, mean low (or lower low) water, mean range (high to low or higher high to lower low) and mean level are to be computed, and, where  $D$  = reading of chart datum,  $M$  = reading of mean level on the tide pole, and  $R$  = mean range, where datum is known; and  $d$ ,  $m$  and  $r$  the corresponding values, where datum is required.

$$d = m - \frac{r(M - D)}{R}$$

Datums can only be so transferred when the type of tide is constant; when the type changes each datum must be established by independent tidal observations. In rivers, where the difference between low water levels at springs and neaps decreases as the river is ascended, and the neap level may eventually become the lower, datums, corresponding as nearly as possible with the International level, must also be independently established at each place.

**76. Tidal observations and analyses.**—Attention is directed to Part III of the Admiralty Tide Tables, the methods therein described and the instructions given for analysing tidal observations are invariably to be followed. Tidal observations are very important and fulfil the double purpose of providing (a) the information required for reducing soundings, and (b) the data for tidal prediction and investigation. For (a), observations are required only whilst sounding is actually in progress, for (b), though under certain circumstances observations for 2 days or even 1 day may be utilised, continuous observations for a minimum period of 15 days, and preferably for a very much longer period, are usually essential; further, for (a), the stations should be so close together that all soundings can be reduced by tides observed in their immediate vicinity, whereas for (b) observations are only required at such distances apart as to show important changes in the range and type of the tide. It thus follows that, in any survey, requirements are best met by the establishment of one or more, depending on the extent of the survey and the tidal changes which occur, principal tidal stations at which continuous observations are obtained for as long periods as possible, with subsidiary stations at which observations are only obtained whilst sounding is in progress in their vicinity, at frequent intervals. Unless harmonic constants depending on a minimum of 15 days' observations are already given in Part II of the Tide Tables, tidal observations for 15 days, or preferably for 29 days, are always to be obtained at suitably placed principal stations, when the duration of the survey admits. If the survey occupies less than 15 days, observations for analysis by the Admiralty method, eliminating the assumptions, should be obtained; such observations should also be obtained, if opportunity offers, whenever the ship is at a place for which "inferred" constants are given in Part II of the Tide Tables.

At all stations, the height of the tide should be observed at regular half-hourly intervals, with observations at shorter, say, 10-minute, intervals near high and low water, so as to obtain these times with the greatest possible accuracy. Where the range of the tide is very great, it is advisable to obtain all observation for reducing soundings at 10-minute intervals. It is of great importance that each of the 48 or 24 heights to be analysed by the Admiralty method should be exact.

When sending observations and analyses to the Hydrographic Department, the fullest possible information regarding time kept, bench marks, reference of tide pole zero to bench marks, reading of chart datum on tide pole, etc., must be given both in the tide journals and in the computation forms. The fullest possible information regarding datum is also to be given on the fair chart. Heights of tide are to be entered in the Journals and forms as observed, referred to tide pole zero not to chart datum; the tidal record is always to be kept in the Zone or other time at the place as shown by the Time Zone chart; summer time is not to be used. If, for convenience, summer time has been used for the "Record of Tide pole readings," the necessary adjustments to Zone time should be made when transferring the heights to the Tide Journal.

When computing harmonic constants, 29 days' tides are always to be used in preference to 15 days'; 29 days' tides will, if computation is correctly performed, provide reliable constants which will not require alteration unless some large tidal change, due for instance to an earthquake, should occur. In view of this fact, and owing to the somewhat involved nature of the computations, the rule to be followed is that one accurate set of constants is to be preferred to a number of sets of doubtful value. Consequently, only one set of constants should be computed for each place, the number of places should not be unduly multiplied and, when possible, each set of constants should be computed by two assistants, working independently, from the same observations. If then differences occur in the constants, errors will easily be found

and corrected by comparison of computations. Tidal observations are always to be analysed by the methods described in Part III of the Tide Tables, and in accordance with the instructions given therein; tidal differences and ratios are also to be computed when a sufficient series of observations is obtained. The Standard Port to be used should be that to which places in the immediate vicinity are referred in Part II of the Admiralty Tide Tables.

Tidal constants are not to be given on the fair charts.

**77. Mean sea level.**—Mean sea level is subject to seasonal variations; also to small long-period fluctuations, which are not fully understood. A computed value is, in consequence, the value for the central day of the observations only and is not constant; if, however, the observations are repeated for the same period in another year, the value will not differ greatly from that originally computed, whereas at other times in the same, or other, year differences may be appreciable.

Information regarding seasonal and long period changes in mean sea level is of great practical importance, even when these are so small as not to affect navigation, for they are closely connected with fishery and other problems.

Mean tide level (average between mean high water and mean low water) is not mean sea level; these levels may differ considerably, especially in shallow water where the shape of the tide curve is altered.

Mean sea level may be computed by averaging the hourly heights of the tide. If the series of observations available is very long, say a year or more, level should be computed for each calendar month separately and detailed information regarding seasonal changes thus obtained; if the period is more than one month, but less than 12 months, the same course should be followed, but information regarding seasonal variations will be incomplete. If more than one month's, but less than two months' tides have been observed, level should be computed for one month only; if the period is 15 days or more, but less than one month, heights for the whole period should be averaged. The computed level is always assumed to be the level on the central day of the computations. If the harmonic constants are computed, mean sea level on the central day is also obtained.

Mean sea level from hourly heights should not be computed if the period of the observations is less than 15 days.

**78. Coastlining.**—Coastline, except in the most rapid and cursory surveys, must always be walked over when its nature permits. Many small river mouths and streams have been missed by the practice of pulling along the coast and only landing here and there.

Coastline is the line reached by mean high water springs and care is sometimes necessary in order to locate it accurately in places where the tidal range is great.

A surveyor employed coastlining should also put in the low water line as far as possible, and should always note the nature of the foreshore. The best way to fix the position of the low water line is undoubtedly by the reduced soundings, but every part of a survey should, if possible, be seen at least once at low water in order to see if there are any dangers which might have escaped detection. This is particularly necessary when the range of the tide is great.

Since the interpretation of the High Water Mark on air photographs is often a matter requiring considerable experience, photographs should only be used to supplement information obtained by walking over.

**79. Coastlining in British Isles.**—As the high water line on the Ordnance sheets of England, Wales and Ireland is the high water mark of ordinary tides, *i.e.*, mean tides, or half-way between springs and neaps, when surveys on those

coasts are undertaken, care is to be taken that the high water line as given on the Ordnance sheets is re-surveyed if necessary; this is particularly important with a shelving beach.

The coastline on Ordnance sheets of the coast or harbours of Scotland need only be checked and amended if necessary, as on such sheets the high water line given is that of spring tides.

**80. Landing places.**—Landing places on coasts only accessible in places must be noted.

**81. Beach Gradients.**—Experience in planning combined operations has shown the vital necessity of knowledge of beach gradients, and knowledge of these may well have peace-time applications. Information on this head is therefore required, and is to be rendered to the Department with the results of surveys.

The following considerations should govern the selection of beaches of which gradients are required :—

- (a) General gradients should be steeper than 1 : 300 below the high water line.
- (b) Large areas of rocky ledges should be avoided.
- (c) Adequate exits from the beach should be as close as possible to the gradients run.

Gradients should be ascertained at intervals of about 100 yards or, if necessary, more closely, along the selected beaches, and should be obtained from a depth of 18 feet to the back of the beach, lines of soundings being run at right angles to the trend of the coastline in the vicinity.

Gradients are to be rendered on Form H.408 (*see* Plate 3). The texture of the beach, both above and below the low water line, should be noted on the form.

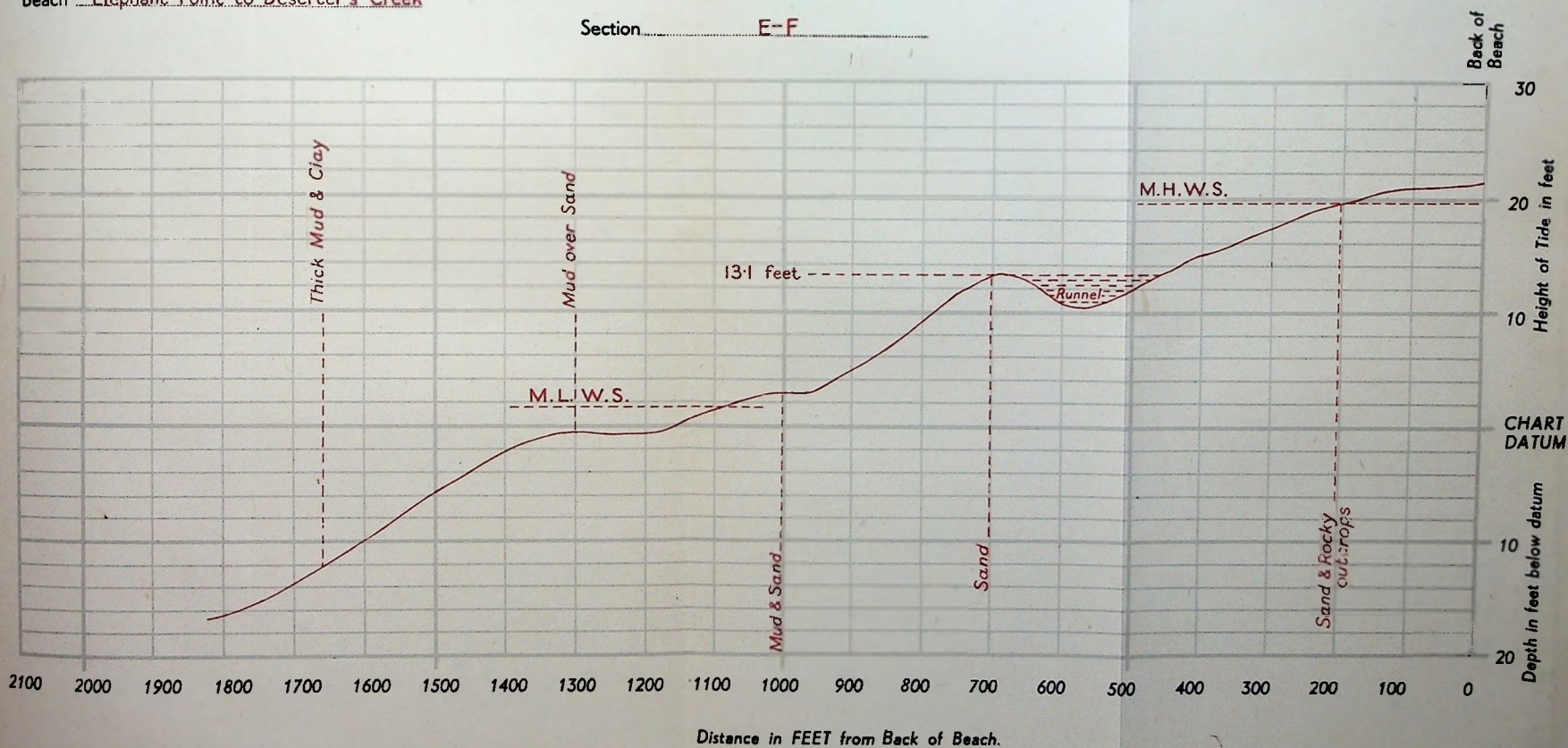
Accompanying gradient forms, a tracing is to be rendered on a convenient scale showing the position of the selected gradients and the beach exits. Gradients should be lettered on the tracing to correspond with the graphs of the sections. The nature of the beach exits and sketched topography in their immediate vicinity should be rendered on sketches to an approximate scale of 1 : 2,500.

The foregoing should be rendered under cover of a report which should contain the following information :—

- (i) Notes on the offshore holding ground.
- (ii) Remarks on wind and surf conditions as they affect landings.
- (iii) Methods used to obtain the gradients.
- (iv) Estimated bearing capacity of the beaches for wheeled and tracked vehicles.
- (v) Possibility or otherwise of utilising the beaches as emergency landing grounds for aircraft.
- (vi) Brief descriptions of the beach exits.
- (vii) Direction and strength of tidal streams near the shore.

**82. Rivers.**—Rivers navigable either by ship or boats must be traced as far as circumstances permit, and the best line in over the bar ascertained.

**83. Height of coastline and rocks off.**—The height of all land bordering the coast must be ascertained, no matter if the elevation be but small, and particularly every small islet and rock which shows its head above water must have its height noted at the time. Cliffs must also have their heights noted, and their colour, if in any way remarkable. All such heights are to be measured from the level of Mean High Water Springs.

**BEACH GRADIENT DIAGRAM**H.M. Surveying Ship "CHALLENGER"General Locality Burma - Rangoon RiverBeach Elephant Point to Deserter's CreekApproximate Position { Lat. 16° 29' 1 N  
Long. 96° 18' 0 EDate September 1939Section E-F



**84. Height of low water features.**—The height of rocks, mudflats, sandbanks, etc., that dry only at certain times of tide, are to be referred to sounding datum and to be given either as "dries so many feet" usually applied to rocks or an isolated sandbank, or in the case of extensive sand or mud flats in underlined figures on the parts which uncover, indicating feet above the same datum. No other system is ever to be used as it tends to confusion.

**85. Topography.**—Topography sketched from the ship, as is often necessary, must be broadly delineated. The distance inland from the coast to which the topographic feature should be shown must depend on circumstances, but the broad rule is that everything visible from the sea should be plotted; in many cases, however, this is difficult to carry out, as in the case of lofty mountains, fronted by lower ranges, at a distance from the coast. When possible, a few expeditions inland to peaks will afford to the Surveyor an opportunity of sketching in the main features of such country with sufficient exactitude. But when this is, as is frequently the case, impossible, an attempt to sketch from a distance the direction of the ranges, valleys, and spurs is a difficult and frequently a delusive task.

Topography should always be taken from Land Survey Maps if any suitable ones are available, and it is the duty of the Officer-in-Charge of Surveys to get into touch with local Land Survey Departments with a view to ascertaining if such maps can be obtained. In home waters, the Ordnance Survey maps of areas under survey can always be supplied if required, but "contoured" maps on a suitable scale are not always available, particularly in Scotland, and in such cases the contouring must be undertaken by the Surveyor.

Photographic reproductions of land survey maps on the actual scale of surveys can be supplied by the Hydrographic Department on demand: applications for such reproductions must always be accompanied by copies of the maps in question.

Consideration should be given to the use of air photography, which may be of value in checking the accuracy of land survey maps and will, in general, save much Plane Table work.

If air photographs are taken during the course of the survey, it will be a distinct advantage to add to the number of control points by setting up white marks in suitable localities which will be visible from the air and appear on the photographs.

It should be noted that in order to show a square of 0.01 inch side in a photograph at a scale of 1 : 25,000, the station must be marked on the ground by a square of 21 feet side.

As a general rule the topography should be put in by walking over the ground in harbour surveys, but too much time should not be spent on this work which is of only minor importance in a hydrographic survey.

**86. Conspicuous objects.**—The positions of all objects which may serve as marks must be fixed. Villages, churches, mosques, pagodas, windmills, and natural marks, such as isolated clumps of trees, are especially valuable.

**87. Fixing floating navigational marks.**—When fixing light-vessels, buoys, etc., it must be borne in mind that the position required is that of the moorings and not of the floating mark itself. As a general rule the best time of fixing a buoy is slack high water, but in the case of light vessels all that is necessary is to fix her position, making due allowance for the bearing and distance of her anchor, which can always be ascertained on the spot. These points require special attention when the scale of the survey is at all large.

**88. Leading lines and clearing marks.**—These must always be actually sounded over or swept; this is especially important in the case of incomplete surveys.

**89. Views.**—Careful attention should be paid to the instructions in Chapter XIX of the "Manual of Hydrographic Surveying" regarding the drawing of views for inclusion in Sailing Directions.

The Surveying Sketch Book H.12 has been specially designed to facilitate the drawing of sketches.

**90. Photography.**—The possibility of using photography for obtaining views of headlands and coastal features, and particularly lighthouses, beacons, etc., should be borne in mind.

Prints of any such photographs, together with their negatives if available, with full particulars as to the position at which the photographs were taken, should be forwarded to the Hydrographic Department to be dealt with as considered desirable.

Expenses for the purpose of films, developing, printing, etc., in this connection are to be paid for out of the "Surveying Contingent" Account. (*See* § 173.)

**91. Wrecks.**—A list of wrecks reported to exist within an area under survey will always be supplied by the Hydrographic Department, together with all available information concerning them. All wrecks are to be searched for by sweeping if circumstances permit, and the least depth over them is to be ascertained.

In the British Islands, action is usually taken to disperse any wreck in an important waterway over which there is a depth of 45 feet or less below chart datum. Such wrecks should invariably be buoyed to facilitate location by the demolition party.

In home waters generally, and particularly in the Thames Estuary, searches for wrecks are frequently a large item in the surveying programme, and, in such cases, the results of all searches are to be included in one report at the close of the season; but wrecks requiring dispersal, and any wrecks hitherto uncharted, or whose present chart depth or position is seriously in error, are also to be reported as soon as discovered. Isolated searches are invariably to be reported when they occur. All reports on searches for wrecks are to be in the fullest detail, and are to be accompanied by tracings showing the areas swept, depth swept to, obstructions located, etc.

**92. Tidal streams.**—Attention is directed to the remarks on tidal streams, and the instructions for analysing observations in Part III of the Admiralty Tide Tables. The direction and rate of the tidal stream, both surface and sub-surface, are to be observed at suitably placed stations in the course of every survey; observations are to be obtained at exact hourly intervals and, though the obtaining of observations for shorter periods must by no means be neglected, it should be borne in mind that definite results cannot be obtained from less than 13 consecutive observations when diurnal inequality is inappreciable, or from less than 25 consecutive observations when there is diurnal inequality. When possible, even where diurnal inequality is inappreciable, the observations should be continued for 24 hours (25 observations).

A single series of 25 observations in one position is of very much greater value than a larger number of observations, in broken periods, at a number of positions. The rule should therefore be, to select suitable positions, in which the stream is of greatest importance to navigation, for obtaining the 24-hour series, and to supplement these by shorter periods of observation at less important positions. Whenever possible, the observations at the principal positions should be repeated.



It must be remembered that, when only 13 or 25 observations are obtained, each observation stands alone; no averaging is possible, as when a series of tidal observations is analysed. A single observation either wrongly obtained or incorrectly recorded may therefore render useless the whole series; it is thus of the very greatest importance that every possible precaution be taken to ensure accuracy, and such observations are always to be supervised by an Assistant Surveyor or a Recorder.

Where diurnal inequality is great, or the stream is diurnal, the observations must be analysed by the Admiralty method; in these cases, two series of observations with a suitable interval between (*see* Part III of the Tide Tables) must be obtained. For analysis by the Admiralty method it is of the greatest importance that every observation should be exact.

Streams of semidiurnal type should be referred to high water (not to low water) at a standard port. The selection of the port of reference may be difficult, for the local tide may not be of the same type as the stream (in Torres Strait, for instance, though the stream is semidiurnal, the tide is diurnal) and reference must be to a semidiurnal tide. As a general rule, the stream in harbours and important anchorages should be referred to local high water, whether the place is a Standard port or not; elsewhere reference should be to the nearest Standard port at which the tide is suitable. In home waters, however, the streams near the land, which will eventually be shown on the large scale coast charts, should be referred both to the nearest Standard port and to Dover, the off-shore streams being referred to Dover only.

The methods of analysing observations of tidal streams are not yet fully standardised, and special forms are not supplied; the forms for analysing tidal observations by the Admiralty method may, however, be used for analyses by that method. All analyses are to be performed in accordance with the instructions referred to and sent to the Hydrographic Department, with the observations.

**93. Currents.**—The direction and rate of permanent and seasonal currents, both surface and sub-surface, is a subject of much interest and great importance, and demands constant attention. Except by means of observation from a ship or boat at anchor, which gives the combined effect of tidal stream and current, all methods of observing must be considered to give approximate results only, which are subject to unknown errors. The method of assuming the difference between the true and dead reckoning positions to be due to a steady current lasting through the 24 hours is unsound, being based on approximate data; that of observing from a boat by dropping a weighted drag, of large superficial area, to a great depth and observing the surface current by current log, even assuming that there is no tidal stream and that the drag has no movement relative to the surrounding water, gives the difference between the surface current and the current at the depth of the drag. Observations obtained of the drift of a boat, from a buoy, moored in deep water, by means of sounding wire and a sinker, are probably more reliable, though there is no certainty that the buoy has not dragged.

The distance off shore, and the depth, to which the tidal streams extend are also generally unknown; it is, however, probable that shallow enclosed seas, such as the North sea, are affected by streams extending to the bottom over their whole area, whereas off coasts where the bottom falls steeply to, to oceanic depths, the streams extend only to a short distance off shore. If there is any tidal stream, observations necessarily show the combined stream and current.

Increase of knowledge regarding currents thus necessarily depends on the examination of a great number of observations, spread over long periods of time, each of which is, in itself, of little value, rather than on single observations.

No opportunity therefore should be lost of obtaining such observations, both surface and sub-surface, by any means which ingenuity may suggest, and when sending such observations to the Hydrographic Department, the methods adopted are to be fully described.

Currents resulting from the analysis of tidal stream observations (*see above*) are to be given with the tabulated streams. Those obtained by other methods are to be sent to the Hydrographic Department on completion of the observations.

**94. Observations for variation on shore.**—The "Manual of Hydrographic Surveying" should be consulted for information as to the methods to be employed with the various instruments provided.

Observations should be rendered in full detail, as obtained, to the Hydrographic Department.

**95. Observations for variation afloat.**—When the true variation is required and observations on shore would be rendered of doubtful value owing to local magnetic attraction, variation should be obtained by carefully swinging the ship in the vicinity in a depth of 50 fathoms, or more if possible. The ship should be steamed round both to starboard and to port, the mean of the two results being taken. Observations should be made with the standard compass on eight or sixteen equidistant points, the ship being steadied for at least a minute on each point in order to allow the sub-permanent magnetism, due to the last direction in which she was heading, to disappear and bearings being obtained of the sun or other heavenly body. Alternatively, a distant land object which has been fixed in the survey may be used if the swings can be made in a position where a station pointer fix can be obtained by angles to surveying marks. The position at each observation should be plotted on the plotting sheet or on a field board, and the true bearings of the distant object at each fix measured off the plot.

Observations are to be rendered in full detail, as obtained, to the Hydrographic Department on Forms S.374a (Record of Observations for Deviation), which should be amended as necessary.

**96. Observations for geographical positions.**—Sights are normally to be obtained with the Prismatic Astrolabe, and time is to be recorded by Chronograph. For all important determinations of position there should, if possible, be at least four observers, each of whom should obtain a minimum of sixteen stars (four in each quadrant).

The observations are always to be worked out by the analytical method described in the "Manual of Hydrographic Surveying" and results are to be forwarded on Form H.194, Return of Geographical Position.

These returns are to be numbered consecutively for each year, the same numbers being given to the returns rendered by each observer for each particular position.

The errors of certain W/T Time Signals are observed at the Royal Observatory, Greenwich, and published every month in Admiralty Notices to Mariners: it is most important that one of these signals should always be used for obtaining time.

These errors which apply in all cases to the original signals signify the correction which is necessary to obtain the exact time of the signal as determined at the Royal Observatory, Greenwich, and they are entirely independent of corrections published from other sources, which must necessarily be dependent on the local determination of time at the place concerned.

As Greenwich is the origin of all longitude determinations, it is essential that Time Signals used in connection with astronomical observations for absolute determination of longitudes should be corrected for the errors actually observed at Greenwich.

Observations for geographical positions with the prismatic astrolabe are to be completely worked out and summarised without waiting for the errors in W/T Time Signals as published in Notices to Mariners.

Geographical positions so obtained may be utilised for the graduation of fair charts and for any other purpose where delay is to be avoided.

In order, however, to provide a safeguard against large errors of transmission and reception, the chronometer errors derived from the *corrected* time signals, covering the period of observations, are to be closely compared with those derived from the *uncorrected* time signals, and if the *rate* derived from the corrected time signals differs from the rate used by more than 0.1 seconds in 24 hours the observations affected must be re-worked. Except in the above cases, observations may be forwarded to the Hydrographic Department as originally worked out. Such observations are to be clearly marked "Uncorrected for errors of Time Signals" under "Remarks" on Form H.194—Return of Geographical Position.

In the event of failure to obtain any of the W/T time signals, published in Admiralty Notices to Mariners or if the number obtained is insufficient to determine the rate of the chronometer during observations, applications for the corrections to other time signals obtained should be forwarded, as corrections which are probably accurate to the nearest second decimal place of a second can usually be supplied. It must be clearly understood that the use of such other signals is to be regarded as a last resort.

No corrections are to be applied on account of "lag" due to the speed of transmission of W/T waves in the time of reception of W/T Time Signals. Such corrections will be applied, if necessary, after the receipt of the observations in the Hydrographic Department.

Good results have been obtained by using a theodolite in a precisely similar manner to the Prismatic Astrolabe, but it must be remembered that in this case all altitudes are not necessarily the same, and each individual observation must be corrected for bubble error before the intercepts are calculated. If no astrolabe is available, the method to be employed is left to the discretion of the Officer-in-Charge of survey, and, if preferred, latitude may be obtained by circum-meridian stars and longitude by equal altitudes, or other suitable methods, using a theodolite. In such cases the final position to be accepted is to be determined by the methods described in the "Manual of Hydrographic Surveying."

**97. Observation spots.**—All observation spots are invariably to be permanently marked, and they are to be connected to a main triangulation (if such exists in the vicinity) either by direct measurement or triangulation, the fullest details of which should accompany the return of Geographical Position rendered on Form H.—194.

**98. Nomenclature.**—Distinct names to points, islands, shoals, and rocks are absolutely necessary in a chart in order to render either the log book, narrative or sailing directions intelligible.

The Surveyor must therefore take every pains to ascertain the acknowledged or native names.

The dual nomenclature which embarrasses the geographer, and renders so many accounts of incidents obscure, frequently arises from new names being bestowed on features which already locally possess others. These latter are

certain to be eventually reported, and as certain to be recognised as the true name, when it is very difficult to shake off the one already appearing on the charts without inconvenience.

When native or acknowledged names are not forthcoming, suitable names are to be selected by the Surveyor, but care must be taken to avoid the repeated use of popular names or the use of those which are already allotted to places in the vicinity; it is to be borne in mind that the too frequent use of any name tends to confuse the gazeteers and perplex the memory.

Names already established should seldom, if ever, be altered, the names given by the first discoverers are accepted by the common consent of all civilized nations.

When it is necessary to give new names an endeavour should be made to make the name convey some idea of the form, character, or productions of the place, and though it is not the intention to debar the officer in charge of a survey from naming shoals, points of land, and other objects after the officers assisting in the survey, this should be done with circumspection.

A study of the many admirable names allotted by Cook to the salient features of the east coast of Australia will repay the time spent, and afford an excellent example of the choice of suitable names.

A Permanent Committee on Geographical Names, short title—"P.C.G.N.," regularises the spelling and is the authority for geographical names in all places outside the United Kingdom and Eire. The decisions of this Committee are communicated to the Hydrographic Department from time to time in "Lists," which are supplied to Surveying Ships as necessary.

In the United Kingdom and Eire the Ordnance Survey is to be regarded as the authority, and names on all fair charts and tracings rendered should be in agreement with Ordnance Survey *maps* when these are used for topography.

In waters of the British Empire where an established Land Survey Department exists, e.g., Malaya, the published maps are to be regarded as the authority, except with regard to names already dealt with by the "P.C.G.N.," and names on fair charts and tracings are to agree with these; old-established names from existing Admiralty charts, where they differ from the above, are to be shown underneath in brackets.

In foreign waters, the published charts and/or sailing directions of the nation to whom they belong are accepted, except for those names for which the "P.C.G.N." has already given a ruling.

**99. Deep sea soundings.**—A more perfect knowledge of the configuration of the sea bed is, highly desirable, and has been made more easily attainable by the introduction of deep sea echo gear. The general rule that a Surveying Ship should take every opportunity of obtaining deep sea soundings when on passage may be interpreted in ships fitted with echo gear as the recording of a sounding every mile up to a depth of 500 fathoms, every two miles thence to 1,000 fathoms, and every five miles over 1,000 fathoms, but this must depend upon the number and regularity of the soundings on the existing chart. It should be noted that a very small deviation from the direct course between two places, if determined on before the passage, may enable a ship to pass through an area in which soundings are comparatively sparse without adding greatly to the total distance of the passage.

In a ship fitted with ordinary sounding gear only, the depth of water and time available are over-riding considerations. "No bottom" soundings and depths by tube or the amount of wire run out are no longer of practical value.

The delineation and slope of the edge of the continental shelf is of scientific as well as of navigational value and the vicinity of the 100 and 1,000 fathom lines is to be considered of special importance.

The results of deep sea soundings are to be forwarded in triplicate on Form H.—37 as soon as possible after they have been obtained. This applies equally to Wire and Echo Soundings, and attention is directed to § 68—Correction of echo soundings.

Unless they are part of a detailed survey for which a fair chart is rendered, soundings of 100 fathoms or more are always to be rendered on the form. In the case of specially ordered sounding cruises or the sounding of areas in search of banks or vigias, a tracing on an appropriate scale, but not smaller than that of the largest scale chart embracing the area, is to be forwarded in addition to the lists on Form H.—37, and is to be accompanied by the details described above.

It has been found by experience that the most critical moments during the process of obtaining a deep sea sounding are when the lead strikes the bottom and when the lead is within 20 fathoms of the surface when heaving in. The latter condition may be consequent on the former if the wire is allowed to slacken on the lead reaching the bottom; here a "kink" is extremely likely to occur, but it will not affect the wire coming in until within a few fathoms of the surface, when the effect of the heave of the ship is most pronounced.

It is therefore desirable to strengthen the wire in the part most likely to "kink" and the following method is recommended.

Reel off from the machine 40 fathoms of wire, double the wire back and commencing at the bight and leaving sufficient for an eye splice, lay up the wire in the centre of a 10 fathom length of 1 inch hemp, working on that portion of the wire which leads direct to the machine. With the wire still in the centre of the hemp stray line, eye-splice the bight on its own part of the hemp. The outboard end of the wire is then twisted back outside the hemp towards the machine and "seized" with twine at intervals of 1 fathom. On reaching the inboard end of the stray line, twist the two parts of wire together until the end is reached, which should now be 20 fathoms from the eye-splice; seize at intervals of 3 feet, using short seizings of the special wire provided for the purpose. At the inboard end of the stray line, roll on and secure a weight consisting of 2-4 lbs. of sheet lead. The lead, driver tube or Baillie Rod, is then shackled to the hemp eye—an advantage when depths are constantly changing and it is necessary to use a different type of lead.

**100. Soundings, etc., obtained on passage.**—Soundings of less than 100 fathoms obtained by Surveying Ships on passage with the object of improving the information given on published charts are to be rendered on tracings from the relevant charts with the new work shown in red. These tracings are always to carry a memoir giving a brief explanation of the methods employed for fixing, and are to show all astronomical positions or position lines, together with a selection of shore fixes sufficient to enable the accuracy of the work to be assessed.

A report is to accompany the tracing giving details of the shore fixes shown and sufficient information regarding astronomical observations to enable their reliability to be judged; the latter should include the number of stars obtained in the case of Stellar observations, and remarks on the general weather conditions.

**101. Nature of ocean bottom.**—All oceanic deposits contain small black, red and yellow-magnetic particles, but these are most abundant in the clays. Should the sounding tube come up empty, as it does occasionally, though rarely, it must be carefully examined on the outside for black-brown streaks, as these indicate the presence of oxide of manganese at the bottom in the form of nodules or stones too large for the tube to bring up.

The specimens recovered from the bottom are to be carefully placed in bottles, marked with the name of the ship, the number of the sounding corresponding to that in the sounding book, position, and depth.

The bottles must be filled with sea water, with a small quantity of colourless spirit added, and forwarded to the Hydrographic Department.

**102. Oceanographical observation.**—Accurate observations of the temperature below the surface with samples of water are of value in connection with echo sounding, sound ranging and oceanography. When such observations are required special instructions will be issued together with the necessary apparatus. The insulating water bottle cannot be used with accuracy at depths greater than 400 metres and the reversing water bottle is used at greater depths. Each type of bottle is fitted with one or more suitable thermometers.

**103. Cold surface water along the coast.**—This is often found where the wind blows parallel to the shore or off-shore, and is due to cold water, upwelling from the depths; this happens in particular in the neighbourhood of headlands. Well known instances are found in the Peru current, off the coast of French West Africa, off the coast of California and along the south-east coast of Arabia. This is of interest in connection with the general circulation of the ocean, and closely spaced observations of surface temperature should be made occasionally when running at right angles to the shore or passing headlands, particularly when deep water is found close in. The temperature should be observed immediately after filling the bucket and the bulb of the thermometer should be kept immersed.

**104. Coral formations.**—For the purpose of investigating theories regarding the formation of coral reefs, etc., observations are much required on the precise slope of their outer edges and of the materials of which that slope is composed.

All opportunities should therefore be seized of obtaining careful sections of such reefs as stand in deep water, both on the windward and leeward side.

The soundings should be obtained at close intervals horizontally, from the edge of the reef, to deep water, say 1,000 fathoms, and the nature of the bottom carefully ascertained.

A special report should be made of such observations, accompanied by sections drawn on an equal scale, vertical and horizontal, of 30 fathoms to 1 inch, the slope being to the left, with a plan of the reef where possible.

**105. Wave measurement.**—Among the other useful observations which should engage the ingenuity of a surveying officer, on his several passages, may be mentioned the magnitude of the waves in those parts of the ocean where the sea has a very great fetch, since there is reason to believe that the height attained, as well as the distance between two following ridges, have been much under-estimated. A good attempt may be made to measure their vertical height by mounting the rigging until a line from the observer's eye to the horizon becomes a tangent to the summit of the intervening wave—the vessel at the moment must be upright, and in the lowest part of the trough between two waves.

Consort vessels, when nearly in each other's wake, and knowing their actual distance apart, by the elevation of each other's masts, can accurately determine the breadth of the valley that separates two of these huge undulating masses. The same result may be obtained by towing an object astern at a measured distance.

**106. Vigias.**—It is the special duty of surveying ships to examine all reported dangers in the vicinity of the survey, or that may lie near their course whilst on passage. The number of these vigias on the charts has been considerably diminished in recent years, but others are frequently reported, and every effort must be made to verify or disprove them. A day will therefore be well employed devoted to the search for any that will not draw a vessel too far from her course or from her surveying ground.

Positive casts must be obtained, "no bottom" soundings being of very little if any value in this kind of search. The Surveyor should be on the alert for any unusual appearance of the sea, such as partial rippings, discoloured water, shoals of fish or even flocks of birds, as they may possibly indicate the existence of shallow water.

In searches of this nature the fullest use of the Deep Echo Sounding Gear should be made if ships are so fitted, but it is necessary to obtain occasional wire soundings in order to ascertain the nature of the bottom.

Every fresh report on the station on which the ship is serving must be enquired into, if possible, from the originator of the report, and if it appears credible, and an opportunity offers, the locality should be examined.

Floating marks should invariably be used for such searches if conditions permit, and, in this connection, it is observed that buoys have been moored successfully with taut wire in depths of over 1,000 fathoms. The number of floating marks to be used must obviously depend on circumstances, but the use of even one will frequently be sufficient to insure that soundings obtained are plotted relatively correctly. The possibility of positional errors which might result in leaving "gaps" in the search can never be ignored if the search is dependent solely on a series of astronomical positions.

**107. Meteorology.**—Instructions for keeping the meteorological log (H.—243) are contained in § 43.

In ships in which the log is not kept, the study of meteorology should nevertheless be continued by all Surveying Officers, and the duty of plotting, on the appropriate meteorological working chart for the area, the daily weather shipping bulletins, should be undertaken by all such officers in turn.

All Surveying Ships engaged on surveys abroad where a meteorological service is non-existent, or where meteorological information is scanty, are to render a special meteorological report at the conclusion of all major surveying operations. This report should be rendered in triplicate under the headings indicated below. Two copies should be rendered direct to the Hydrographer and a copy inserted in the meteorological log H.—243 :—

(i) **Wind.**—

Frequency of spells of various lengths, e.g., spells of 3 days S.W. wind twice a month.

Changes of direction from open sea towards and on coast.

Sudden changes of direction and/or speed at fronts.

Sudden setting in of certain winds.

Marked departures from gradient speed and/or direction.

Changes with height (by cloud observation).

Land and sea breezes—distance seawards and landwards—vertical extent—times of setting in and falling off.

Forecasting : degree of accuracy obtained and any special difficulties

(ii) **Special winds.**—Additional local information regarding special winds mentioned in relevant Handbook of Local Meteorology (if issued).

**(iii) Gales.—**

Relative frequency and severity from various directions.  
 Whether much greater than or less than gradient wind.  
 Variation of speed with height.  
 Length of spells.  
 Daily variation.  
 Forecasting : accuracy obtained and special difficulties.

**(iv) Visibility.—**

Give any observations supplementing data in Tables of the Handbook of Local Meteorology (if issued).  
 Ranges—landwards, seawards, and (if possible) vertically.  
 Daily variation.  
 Relative frequency of haze and fog or mist.  
 Check the accuracy of the local weather reports, if those are available, so as to find corrections (if any) to be applied to local statistics.  
 Forecasts : accuracy obtained and special difficulties.

**(v) Cloud.—**

Frequency of completely overcast sky with cloud at one level or at more than one level, and accompanying type of pressure distribution.  
 Ditto for cloud amount less than three-tenths.  
 Specially prevalent types.  
 Daily variation.  
 Relation to wind direction in various seasons.

**(vi) Sea and swell.—**

Relation to wind direction and speed.  
 Quickness of getting up.  
 Whether more or less than would be expected from wind speed.  
 Circumstances in which rough sea accompanies light winds.

**(vii) Rain, etc.**

Types, *e.g.*, showers, continuous, drizzle, hail, snow, with accompanying meteorological circumstances.  
 Spells of—frequency and length.

**(viii) Temperature.—**

Spells of high or low.  
 Extremes.  
 Relation to wind direction and speed.  
 Sudden changes—magnitude and circumstances.  
 Daily variation in different weather types and at different seasons.  
 Effect of land and sea breezes.

**(ix) Sea temperature.—**

Characteristics at different seasons.  
 Changes from land seawards.  
 Differences from year to year.  
 Effect of land and sea breezes, and of other wind directions and speeds.  
 Uniformity or patchiness.

**(x) Humidity.—**Relative and absolute values.

Extremes.  
 Daily variation at different seasons and in different types of weather or wind.  
 Relation to wind direction and speed.  
 Sudden changes.



(xi) **Miscellaneous.—**

Thunderstorms.

Mirage.

Dust or sand storms, whirlwinds—vertical thickness, visibility in manner of formation or dissipation.

(xii) **General.—**

Whether passage of different types of fronts, and presence of different types of air masses are clearly recognisable from the local observations.

What departures there are from the usual characteristics in such cases.

Local effects which obscure the indications of the ordinary daily observations in relation to the passage of fronts.

Exceptions to the usual rules regarding the effects of the passage of fronts, *e.g.*, in wind, cloud, rainfall, etc.

(xiii) **Suggested further amendments to the Handbook of Local Meteorology.—**

Indicate any other amendments to the Handbook of Local Meteorology (if issued) which are considered to be required, giving reasons.

NOTE.—The Expression "Surveying Season" should not be used, the time of year to which the report refers being stated always. The exact area to which the report applies should be clearly stated.

**108. Information on natural history or other scientific subjects.—**The Surveyor should endeavour to collect any specimens that may tend to the perfection of the national collections. There are manuals of scientific enquiry which contain, under the head of Botany, Zoology, and Geology, many hints as to how best to further these objects. Oceanic islands are seldom without their special fauna and flora, and observations upon these phenomena are always of use to scientists at home occupied in investigations upon the history of the globe.

The British Museum is always ready to provide collecting cases and tanks when there is any probability that they will be utilised. It is very seldom that any collection of specimens from little known parts of the world does not contain some objects new to science, and the most insignificant insects or animals are often most valuable.

Specimens of rock from all little known shores should be collected and labelled with the locality where obtained. These are especially valuable from oceanic islands, which, though generally of a volcanic origin, comprise some remarkable exceptions.

Boxes of typical geological specimens are supplied to all surveying ships on foreign stations.

It should also be borne in mind that surveying officers are frequently brought into contact with savage races and tribes about whom little is known.

Observations upon their customs, religious and civil ceremonies, folk-lore, dress, physical and moral qualities, etc., are often of great service to the anthropologist, and naval officers in the past have frequently advanced the cause of science by their notes and observations upon the natives of the places they have visited.

The Royal Anthropological Institute issue a form to all travellers giving particulars of useful information which can be obtained by people with no previous training or knowledge.

## SECTION IV.

## DRAUGHTSMANSHIP.

**109. General remarks.**—The necessity for neat draughtsmanship should be impressed on all assistant surveyors at the outset of their careers in the Surveying Service. Whilst it is admittedly impossible to reach the highest standards without possessing a natural talent for drawing, ordinary good and neat draughtsmanship is within the power of almost anybody, being mainly a question of care and practice.

A bold style should be cultivated, and very small letters and figures should be definitely discouraged unless the size is dictated by the available space. It is, of course, essential that everything must be clearly legible, and too much care cannot be taken in the correct formation of both letters and figures. Care is also necessary to see that the ink used is not "washed out," and anything in the nature of very delicate penmanship should be avoided.

**110. The Fair Chart.**—The drawing of the Fair Chart is a work requiring the utmost care, so that the smallest details are clearly laid down with precision and accuracy. Moreover, as the time allowed for drawing it is generally ample, the artistic capabilities of the Surveyor should be encouraged and be given free scope, being restricted by the instructions for the representation of the various details as laid down herein. These must be carefully adhered to, as it is only by following them that a faithful photographic reproduction of all details on the fair chart can be ensured; this is an essential point, as it has long been the practice of the Hydrographic Department to reduce fair charts, when necessary, to smaller scales by photography, rather than by the laborious process of squaring down.

**111. Scales.**—The scale on which a survey is made is generally communicated by the Hydrographer, the leading rule being that the chart must show all the necessary details of the coast, etc., corresponding to the area charted. The scale on which it may afterwards be expedient to publish the survey rests entirely with the Hydrographer, and depends on a variety of circumstances.

Unless there are special reasons to the contrary, surveys are always to be made on one of the standard scales enumerated on Admiralty Chart Misc. 19, and scales of 1/50,000, 1/25,000, and 1/12,500 respectively will normally be used for coastal, approaches and harbour surveys.

**112. Survey limits.**—As a general rule the precise limits of a survey are clearly defined in Hydrographic Instructions, and they should not be extended without reference to the Hydrographer except for the purpose of "joining up" with previous work (*see* § 58). If, however, the limits of a survey are left to the discretion of the Officer-in-Charge of the survey, it is necessary to scheme them with the "published chart" in view. It must be borne in mind that the Admiralty charts are generally published on paper known as Double Elephant, of which the engraved portion, within the inner margins of the graduation, measures 38 inches by 25 inches, and in special cases, of what are called Long Double Elephant, of which the length is extended up to a maximum of 55 inches while maintaining the width at 25 inches. Surveys of smaller dimensions than the above are included in sheets of plans which are usually assembled on Double Elephant sheets. Under normal circumstances the limits of sounding should be rectangular on the true meridian.







**113. Graduation.**—All fair charts are to be graduated by the methods described in the "Manual of Hydrographic Surveying" unless their size is such that a full minute of latitude cannot be shown on the graduation. The only exceptions to this are surveys out of sight of land of a scale of under 2 inches to the sea mile, which are to be graduated on Mercator's Projection. Diagram No. Misc. 19 supplied to all surveying ships shows the style of graduation, etc., and is to be strictly adhered to.

In order to nullify the effects of distortion whether on mounted paper, tracing paper, tracing cloth or Kodatrace, a close graticule is to be shown.

Since a large number of parallels and meridians tend to confuse the detail, their intersections only are to be shown, in brown ink, by a circle of 0.1 inches diameter with lines drawn 0.1 inches long from its circumference in a North, South, East and West direction.

Such marked intersections are to be so spaced that, when joined, the meridians and parallels will form rectangles no side of which will be longer than 6 inches.

These intersections should be pricked through from the plotting sheet when the document is prepared rather than later, by which time handling or water colour tinting may have caused uneven distortion.

**114. Meridians.**—A true meridian is to be drawn on all ungraduated fair charts or tracings and is to pass through a main station or astronomical observation spot or other fixed point, but on a graduated sheet the insertion of a true meridian is not necessary.

The magnetic meridian is never to be drawn nor are compass roses to be inserted on fair charts or tracings.

**115. Sizes of fair charts.**—Fair charts are not to be forwarded on very large sheets, the limit of the size being 6 feet by 3½ feet. It sometimes occurs that the survey covers more paper than this, in which case the points should be transferred to sheets not larger than the above, overlapping one another sufficiently to provide connecting points, which may, if necessary, be assumed ones.

**116. Paper to be used.**—The paper on which the fair chart is drawn is to be in the linen-backed paper supplied.

**117. Care of drawing paper.**—Every care is to be taken to keep the paper in as dry a place as is possible, but it often becomes hairy and therefore troublesome to work upon, especially if at all old or if the climate is at all humid. This defect may sometimes be remedied by passing a hot iron over the paper, care being taken to interpose a dry sheet of thin paper between the face of the iron and the paper under treatment.

**118. Colours to be used.**—Colour washes are to be used, and are to be as light as possible, but care must be taken to see that no undue distortion results from their use. Large areas should not be washed all over, but the edges should be tinted with a ribbon of wash about 3 inches wide: this applies both to land and water tints. Too great elaboration in working up sand or mud flats, low water rocks, coral, etc., is to be avoided; this is especially the case where the low water line is in close proximity to the high water line. Indian ink is generally to be used for all details on the fair chart, but the following colours are to be used in depicting various features in order to distinguish them more clearly. The remarks as to the application of colours, etc., must be carefully studied and followed.

## COLOURS TO BE USED.

(See Plate No. 4.)

Objects to be represented.	Colours to be used.	Remarks as to application of colour.
Arbitrary or Assumed points	Prussian green ..	For connecting overlapping sheets. Circles of 0.2 inch diameter.
Breakers	Red .. ..	—
Bridges, stone or iron	Red .. ..	—
wood	Black .. ..	—
Cables	Red .. ..	—
Coral (drying reefs)	Light red, burnt sienna	Burnt sienna pale wash, burnt sienna and light red pen work for shu.
Cultivation	Prussian and Hooker's green No. 2	Hooker's green pale : a, prussian green pen work.
Dredged area	Neutral tint or Payne's grey	Very pale wash, breaking blue water tint if necessary. (See also limits of dredged or swept areas.)
Eddies	Red .. ..	—
Fathom lines	Red .. ..	Continuous firm line for 1, 3 and 6 fathom lines ; above these the recognised symbols.
Fixed marks used during survey	Red .. ..	Circles of 0.1-inch diameter. Very small black circles ; also used where it is desired to represent spires, beacons, etc.
Floating beacons	Black .. ..	As for fixed marks or main triangulation stations, with anchor or anchors added.
Fishing stakes	Blue .. ..	—
Graticule intersections	Red .. ..	—
Gravel	Brown .. ..	Circles 0.1-inch diameter with 0.1-inch lines from circumference in N., S., E., and W. direction.
Grass land	—	See Stones.
Heights above H.W.	Prussian green ..	—
" L.W.	Red .. ..	Upright figures, no brackets.
" L.W.	Black .. ..	Upright or sloping figures, underlined in black.
Hill contours	Grey, neutral or black	Can be shaded by horizontal shading of the same colour, but much lighter or stippled with light washes.
H.W. line	Black .. ..	Continuous firm line.
Houses and buildings	Red .. ..	Pale red wash shaded with dark red, small isolated buildings dark red only.
Kelp	Indian yellow ..	—
Lakes	Prussian blue ..	Pale wash, black outline.
Land tint	Burnt sienna, Hooker's green No. 2	Very pale washes only allowed.
Letters for trigonometrical stations	Red or blue ..	Red for shore stations. Blue for floating stations (See § 143.)
Leading lines, etc.	Red .. ..	Firm continuous as far as line is to be used, but dotted where prolonged to the objects.
Limits of dredged or swept areas	Red .. ..	Light pecked line.
L.W. line, sand or stones, etc.	Red .. ..	Continuous firm line.
L.W. line, mud	Black .. ..	Pecked line.
Mangroves	Prussian green ..	Pale washes and dark pen work, edges of mangroves to be shown in blacked pecked lines.
Marsh	—	See Swampy ground.
Mud (low water)	Payne's grey ..	Regular dotting. (See also L.W. line, mud.)
Meadows	—	See Grass land.
Observation spot	Red .. ..	Cross thus +.
Piers, stone or iron	Red .. ..	—
wood	Black .. ..	—
Railways	Black .. ..	Continuous firm line with very short lines at right angles.

## COLOURS TO BE USED—continued.

Objects to be represented.	Colours to be used.	Remarks as to application of colour.
Reefs (drying rocky ledges)	Raw sienna ..	<i>Pale wash and black pen work for shading, also for rocks.</i>
Rivers .. ..	Indigo .. ..	<i>Stream by a line, where it is broader a double line, and may be washed with prussian blue.</i>
Roads .. ..	Burnt sienna ..	<i>Pale wash and dark double lines for shading.</i>
Rocks (low water)	—	<i>See Reefs.</i>
Sand (high water)	Black .. ..	—
.. (low water)	Indian yellow ..	<i>Regular dotting. (See also L.W. line, sand.)</i>
Sandhills .. ..	Black .. ..	—
Seaweed .. ..	—	<i>See Kelp.</i>
Shingle .. ..	—	<i>See Stones.</i>
Soundings .. ..	Black .. ..	<i>See §§ 123-4.</i>
Stones (below H.W. line)	Burnt sienna ..	<i>Pale washes to represent the stones, etc., shaded with dark colour. (See also L.W. line, stones.)</i>
Streams .. ..	—	<i>See Rivers.</i>
Swampy ground ..	Prussian blue ..	—
Summits .. ..	Red .. ..	<i>Fair-sized dot. (See § 143 as to when to be used.)</i>
Swept areas ..	—	<i>See Dredged areas.</i>
Tidal stream reference symbol	Red .. ..	<i>See § 129.</i>
Tide rips .. ..	Red .. ..	—
Tracks over bars, etc.	Red .. ..	<i>Pecked lines, when the tracks have been run.</i>
Trees .. ..	Hooker's green No. 2	<i>Very pale wash to represent the trees, shaded with dark colour.</i>
Trigonometrical stations:		
Main .. ..	Red .. ..	<i>Circles of 0·2-inch diameter surrounding a triangle.</i>
Secondary and semigraphically co-ordinated	Red .. ..	<i>Circles of 0·15-inch diameter. (See also Floating beacons.)</i>
True Meridian ..	Red .. ..	—
Water tint .. ..	Cobalt blue ..	<i>Dark from L.W. line to 1 fathom line, light between 1 and 3 fathoms; ribbon of tint at 6-fathom line.</i>
Writing .. ..	Black .. ..	<i>Without exception all descriptive writing and names are to be in black.</i>

NOTE.—The word "firm" in the remarks column is used to indicate a fairly heavy line in distinction from a light one.

The signs and abbreviations as given on Admiralty diagram No. 5011 "Signs and Abbreviations" are invariably to be followed.

Plate No. 4 shows the method of colouring to be adopted in representing the various details, and Plate No. 5 shows a photographic reproduction of the same, in which it will be observed that no necessary details are lost in photographing when the above specified colours are used.

119. **Mode of writing names, etc., on the fair chart.**—Nothing tends to enhance the appearance of the completed drawing more than a systematic method of lettering. Different characters are to be used for different objects, and the writing must be horizontal or curved as necessary. Plates illustrating examples of correct and incorrect curvature will be found in the "Manual of Hydrographic Surveying."

To avoid illegibility of names on fair charts owing to the congestion of soundings and other necessary details :—

- (a) In Home waters and in areas where the names are already shown on the appropriate Ordnance Maps, they may be omitted from the Fair Chart.
- (b) In Foreign waters where new names are given to land and sea features, they may be omitted from the Fair Chart, but are to be included in the Sailing Directions accompanying it, together with geographical co-ordinates in order that they may be accurately located.

**120. Styles of lettering on the fair chart.**—The various styles of lettering to be adopted are shown on Plate No. 6. Copies of a diagram (No. Misc. 3A) showing the complete alphabet for all these styles are supplied on demand to all Assistant Surveyors, and an additional copy is to be demanded by each Survey for framing and hanging in the Chart Room. These styles of lettering are to be used as follows :—

**DOUBLE STONE, ORNAMENTED.**—All words written in this character to be capitals. To be used for titles of large fair charts.

**DOUBLE STONE, SHADED.**—All words to be in capitals. To be used for titles of smaller fair charts.

**SINGLE STONE, SHADED.**—May be used in place of the above, or for smaller fair charts and insets thereon. All in capitals.

**SINGLE STONE, OPEN.**—Instead of Single Stone, Shaded. All in capitals.

**ROMAN ORNAMENTED.**—For small fair charts, in place of the two next above if desired. All in capitals.

**ROMAN SHADED.**—If desired in place of Roman Ornamented. All in capitals.

**ROMAN CLARENDON AND CLARENDON PRINT.**—For titles of small fair chart in lieu of above. All in capitals. In capitals and print for all conspicuous objects and lists of conspicuous objects.

**ROMAN BLACK.**—For all principal names on the land, on large scale fair charts. All in capitals.

**ROMAN BLACK SLOPING.**—For names of important seas, gulfs, bays, rivers, estuaries, straits, lagoons, or other parts of the sea.

**EGYPTIAN CAPITALS.**—For names of important peaks, mountain ranges, etc., and railways on large scale charts.

**SLOPING EGYPTIAN CAPITALS.**—For names of large reefs or patches of shoal water on large scale charts.

**EGYPTIAN PRINT.**—For names of mountain ranges, hills, peaks, etc., railways and beacons.

**SLOPING EGYPTIAN PRINT.**—For names of reefs, patches of shoal water, etc.

**EGYPTIAN STUMP.**—In lieu of Sloping Egyptian Print on small scale charts.

**PRINT.**—For names on land of secondary importance. Each name to commence with a Roman Black.

**SLOPING PRINT.**—For names on sea and rivers of secondary importance. Each name to commence with a Roman Black Sloping.

**STUMP.**—For all unimportant names and writing. Each name to commence with a Roman Black Sloping.



Names and Styles of Lettering.

Single Stone Open

A B C D E F G H I J K

Times Roman

A B C D E F G H I J K L M N

Roman Clarendon & Clarendon Print

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

Roman Black

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Roman Black Sloping

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Roman Numerals

I II III IV V VI VII VIII IX X XI XII

Egyptian Capitals

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Egyptian Print

a b c d e f g h i j k l m n o p q r s t u v w x y z

a b c d e f g h i j k l m n o p q r s t u v w x y z

Egyptian Stump

a b c d e f g h i j k l m n o p q r s t u v w x y z

Print

a b c d e f g h i j k l m n o p q r s t u v w x y z

a b c d e f g h i j k l m n o p q r s t u v w x y z

Stump

a b c d e f g h i j k l m n o p q r s t u v w x y z

Hair-line Print & Stump

a b c d e f g h i j k l m n o p q r s t u v w x y z

a b c d e f g h i j k l m n o p q r s t u v w x y z

Numerals

0 1 2 3 4 5 6 7 8 9  $\frac{1}{2}$   $\frac{3}{4}$  0 1 2 3 4 5 6 7 8 9  $\frac{1}{2}$   $\frac{3}{4}$

0<sub>1</sub> 0<sub>2</sub> 0<sub>3</sub> 0<sub>4</sub> 0<sub>5</sub>  $\frac{1}{2}$   $\frac{1}{3}$   $\frac{1}{4}$   $\frac{1}{5}$  etc.



**HAIR LINE PRINT AND STUMP.**—For notes, descriptive words and natures of the bottom, and names, and all writing in connection with work of a sketchy or approximate character either on land or water.

It will be observed from the above that the general principle employed in regard to names is that names of land features are written in upright characters, and names of water features are sloping.

With regard to abbreviations, the types of lettering used are to conform with Admiralty Diagram No. 5011 (Signs and Abbreviations) except that the characteristics of lights and fog signals on buoys are always to be written in *sloping* Egyptian Print.

**121. Fathom contour lines.**—The following contour lines are to be inserted: 1, 3, 6, 10 and 100. In special cases the 20 and 50 may also be shown, and for oceanic soundings, the 1,000 fathoms contour.

**122. Units for soundings.**—Soundings on fair charts and tracings are always to be inserted in fathoms and feet, up to 10, inclusive, and in fathoms only for greater depths.

The line in the title is to read :—

• SOUNDINGS IN FATHOMS (in Egyptian Caps)

(UNDER 11 IN FATHOMS AND FEET) (in Egyptian Print).

The only exception to this rule are the larger scale (1/500) tracings used for the preparation of sunprints for supply to dockyard authorities, on which the soundings are to be inserted in feet.

Drying heights are always to be shown in feet.

**123. Soundings.**—Of the soundings obtained, as many as possible as can be clearly shown are to be inserted on the fair chart. They will often be in greater profusion in shoal areas or where the bottom is uneven; in such cases and when accurate detail is necessary, the figures are to be reduced in size, though they are never to be so small as to lose legibility or opaqueness. Bold figures after the style of the upright numerals on Plate No. 6 are normally to be employed and may be either sloping or upright, but preferably the former. Care is necessary to place the feet figures in the correct position relative to the fathom figures.

The "copper plate" type of sounding should never be attempted by any but draughtsmen capable of the finest pen work. It is seldom satisfactory for closely sounded areas.

**124. Soundings obtained by Echo Sounding Recorders.**—When soundings of 11 fathoms or over obtained by echo sounding recorders are so regular that it is possible to show a sequence of more than five of the same depth, the terminal soundings only may be inserted, and provided the record is continuous, the intervening space filled in by a firm black line. On drawings or tracings supplied to Authorities other than the Hydrographer, this convenience is not to be made use of.

**125. Rocks.**—The symbol shown on Admiralty Diagram No. 5011 for a rock, awash or with less than 6 feet over it, is to be used to indicate :—

(a) An isolated or pinnacle rock or reef of small extent in an exposed position.

(b) Shallow depths, not necessarily less than 6 feet, over a rocky bottom on small scale fair charts.

- (c) A known rocky ledge or coral reef over which soundings have not been regularly obtained, but on which depths are known to be in general less than 6 feet.

NOTE.—Should it be necessary to give the exact depth, as, for instance, as at (a) above, it is to be included in the Sailing Directions accompanying the fair chart.

On fair charts where detailed soundings have been obtained over extensive shallow rocky or coral areas, the actual depths are to be shown, care being taken to insert a sufficient number of indications of the nature of the bottom.

This symbol should be boldly drawn and generally should be of similar size to the soundings on the same fair chart.

**126. Qualities of the bottom.**—These are to be freely interspersed amongst the soundings, the recognised abbreviations shown on Diagram No. 5011 being used, and if the closeness of the soundings prevents the qualities of the bottom being shown a cloth tracing is to be forwarded showing them. When the quality of the bottom is found to be in layers, it is to be so shown, e.g., "M. over S."; bottoms are always to be inserted in *upright* letters irrespective of whether soundings are upright or sloping. If the quality of the bottom throughout a survey is of uniform character it will be sufficient to insert a note to this effect in the memoir.

**127. Swept areas.**—Swept areas are only to be shown on fair charts if the sweeping operations are undertaken to verify the existence of a certain depth: if, owing to the closeness of soundings, the area cannot be clearly shown, it should be shown on a tracing accompanying the fair chart, such tracing being referred to in the memoir.

If sweeping operations are undertaken in connection with the search for a definite rock or obstruction, the areas swept are invariably to be shown on a tracing accompanying the report of the search.

**128. Tidal information.**—Tidal constants are not to be given on a fair chart, but the datum to which soundings have been reduced is to be described in detail under the title, giving the connection to Ordnance Survey, or other Land Survey, datum, as well as to local benchmarks. References to tidal observations obtained during the survey are to be included in the "Memoir." (See §§ 146-7, "Title" and "Memoir.")

**129. Tidal streams.**—All information concerning tidal streams on the fair chart is to be included in the Memoir (see § 147) and referred to by means of the special symbol shown on Admiralty Diagram No. 5011, which is to be drawn in red, with the initial letter also in red in "Roman black" characters.

No tidal stream information other than this symbol is ever to be inserted amongst the soundings except references to eddy streams.

Tidal stream arrows are never to be shown on the fair charts.

References in the Memoir should include the approximate positions of the observing stations (either by bearing and distance or by geographical position) and should be in one or other of the following forms:—

- (a) When the minimum observations required for the computation of detailed information have been obtained, whether the observations have been analysed or not, insert "See Tidal Stream and Current Journal (observations have or have not been analysed)." The observations in the Journal are to be lettered as on the chart.

- (b) When, although the minimum observations required for the computation of detailed information have not been obtained the times of turn and general direction and rates of stream have been ascertained, insert note thus :—

East-going stream commences                      hours after H.W. at  
Rate (Spring, Neap or Average)                      kn.

West-going stream commences                      hours before H.W. at  
Rate (Spring, Neap, or Average)                      kn.

- (c) When the information is indefinite, that is where only the directions of the streams and possibly the rates are known, give brief statements of the information available.

**130. Currents.**—Currents are not to be shown on the fair chart, but any special observations obtained are to be referred to in the "Memoir" (see § 147).

**131. Breakers.**—The information that a danger shows itself by breakers is often of great value to the navigator, and the note "breaks," "breaks in heavy weather," "breaks at half tide," etc., as the case may be, must always be written against such dangers.

**132. River Bars.**—The best line in over a bar when ascertained is to be shown on the fair chart.

**133. Leading lines and clearing marks.**—These are not to be shown on the fair chart unless they have been sounded over or swept. Although as a general rule it is sufficient for navigational purposes to show the bearings of leading lines and clearing marks to the nearest degree on the published charts and in publications, such bearings should be shown more accurately on the fair charts in cases where this is possible.

**134. Overfalls, tide-rips, and eddies.**—These are to be shown by the recognised symbols, with a note as to their dangerous character if necessary.

**135. The coastline.**—This must be drawn in with a firm continuous black line of equal thickness, clearly distinguishable from the low water line or other low water features; the only exception being in the case of mangrove coastline, which is to be shown as a black pecked line. Every care must be taken in transferring it from the fair tracings.

When it is desired to take coastline and topographical details from ordnance maps, application should be made to the Hydrographer for the maps to be photographed on to the required scale and for tracing paper impressions to be supplied for transferring the detail to the fair chart. (See also § 85.)

**136. Wooded hillsides, cultivation, marshy land, trees, grass, etc.**—These may be indicated by written remarks, particularly in large areas, but otherwise it is preferable to use the recognised symbols, and in some cases this is essential; for instance, a cultivated hillside constituting a clearing mark, gaps in trees or tree clumps, etc.

**137. Cliffs.**—These must invariably have their heights given, and should be clearly shown for they are often very imperfectly shown on maps; where their colour differs from their surroundings it is to be given.

**138. Spires or towers of churches, etc.**—These and other conspicuous features of buildings are to be clearly shown by small black circles, with reference to their positions as regards the remainder of the buildings on which they may be situated.

**139. Conspicuous objects.**—These are to be distinguished by the style of lettering used for their names (Clarendon Print) and are also to appear in a tabular form under the heading "Conspicuous objects."

The word "conspicuous" is never to appear against an object on the body of the fair chart.

**140. Heights.**—These are to be freely interspersed, and are to be given in feet above mean high water springs. Where the heights are dependent on imperfect observations the word "about" is to be inserted against them; and where the height is given to the tops of trees the fact is to be stated and the word "about" added, thus:—"Tops of trees about 120 feet." In the case of beacons, lighthouses, spires, chimneys, etc., the total height of the object above mean high water springs is to be given on the fair chart and shown in brackets. The height of the object itself above the ground is to be included in the accompanying Sailing Directions if necessary.

As heights of hills, etc., can seldom be absolutely measured it is generally sufficient to give such heights to the nearest even 5 feet. Every small islet and rock must have its height given, and heights above low water are to be shown against drying rocks, sandbanks, mud flats, etc. The term "awash" is only to be used when a danger is awash at low water; where it is awash at any other state of tide, it is to be shown as "dries so many feet."

Particular care is necessary to see that all heights are clearly legible, as the fair chart is the only permanent record of them.

**141. Representation of hills and mountains.**—Contours or "form lines" are always to be used for representing hills and mountains, the height between them varying with the nature of the country and the scale of the chart. Contours should be close enough to clearly show the general formation of the ground, and should naturally be closer on the flatter types of country. It is, of course, obvious that the distance between contours should increase as the scale decreases.

Some method of shading is to be employed to show up the hill features in relief, and the best and most artistic results can probably be obtained by the use of washes of colour; this method, however, requires considerable skill for its successful performance, and there is a danger of distortion if large areas have to be washed over. As an alternative the actual contour lines may be thickened up on their dark sides, and the effect of this can be accentuated by a series of additional broken contour lines between the main contours. There is no objection to the use of other methods which may suggest themselves to individuals, provided always that there is no departure from the main principles on which the shading is based.

The light is always to be assumed to come from the north-west, so that the south-eastern sides of hills, etc., are in the deepest shadows, and care must be taken that the contour lines are not obliterated by the shading. If shading is carried out with a wash of Indian ink, it is essential that "stick" ink should be used, as bottled ink is waterproof and will not dilute properly.

It is essential that any outstanding features, such as cliffy contours, and precipitous ravines, should be clearly indicated if they are visible seaward.

**142. Topography.**—Topography is always to be taken from land survey maps if any suitable maps are available, these may be amended where necessary from air photographs (*see* §§ 78, 85). Tracing paper impressions of Ordnance Survey Maps photographed on to the scale of the survey can always be supplied on application to the Hydrographer, and other land survey maps can be similarly treated if required (*see* § 85).

**143. Marking stations and summits.**—All main triangulation stations are to be shown by a triangle enclosed by a circle 0·2 inches *diameter*: red for shore stations, and blue for floating beacons. The distinguishing letter against a main station is not to appear on the fair chart unless it is referred to in the Title or Memoir, and, if shown, is to be in Egyptian Capitals or Egyptian Print, and the same colour as the station.

Secondary and semigraphically co-ordinated stations are to be shown by a circle of 0·15 inches *diameter*.

All other stations or fixed points on the land, whether natural objects or survey marks, such as white-wash marks, are to be shown in red by a circle 0·1 inches *diameter*. The summit of hills or "spot heights" that are fixed, but are not stations or marks, are to be shown by a red dot, large enough to be distinguishable.

Floating beacons are always to be shown as blue circles 0·2 inch *diameter* with one or two anchors according to whether they are at single anchor or moored. (*See* Plate No. 4.)

**144. Observation spots.**—The exact positions of the Observation spots are to be clearly marked on the fair chart by a red cross.

**145. Areas surveyed on larger scales.**—When any portion of the area of a fair chart has been surveyed on a larger scale, the limits of the larger scale survey are to be indicated by a firm red line, and a reference to the title of the relevant fair chart is to be inserted in red in bold characters within the area.

Such areas are not to be "squared down" into the smaller scales.

**146. The title of the fair chart.**—No abbreviations, except as shown below, are to be used in the title of the fair chart. The lettering of the name of the sheet is to be in one of the styles specified for the purpose in § 120, the remainder of the title is to contain the following information and is to be printed according to the following lettering. (*See* Plate No. 6 for explanation of lettering):—

Surveyed by, etc. ... ..	Roman Black.
Assisted by, etc. ... ..	Print.
H.M. Surveying Ship ... ..	Egyptian Capitals.
Date ... ..	Block Numerals.
Geographical Position ... ..	Print.
Line Indicating Heights ... ..	Stump.
Soundings in fathoms or feet ... ..	Egyptian Capitals.
Under eleven in fathoms and feet ... ..	Egyptian Print.
Datum for soundings ... ..	Stump.
Natural Scale ... ..	Stump.
List of Conspicuous Objects ... ..	Clarendon Print.

**147. The memoir.**—A memoir is to appear on the fair chart in "Stump," with the title in "Egyptian Capitals," and can be shown in the most convenient place. It is to contain the following information:—

- (i) How the chart is constructed, *e.g.*, from a regular or irregular triangulated survey, or sketch survey; and on what the triangulation depends, *i.e.*, measured base, ordnance survey triangulation, etc.

- (ii) References to triangulation data, or original documents appertaining to the triangulation.
- (iii) A list of calculated geographical positions of selected main triangulation stations, together with the position from which they are derived.
- (iv) References to returns of Geographical position, or documents or correspondence relating to the accepted origin of the geographical positions.
- (v) How the chart is plotted and graduated.
- (vi) Whether the topography is sketched in from the ground, or from the ship and, if from other sources, the authority in full detail.
- (vii) A statement indicating the use made of air photographs.
- (viii) A concise statement regarding the tidal observations obtained, including positions of tide poles and duration of observations at each, and whether harmonic and non-harmonic constants have been computed. Stations at which observations were obtained for reducing soundings only need not be included, but if no other observations have been obtained this fact is to be stated.
- (ix) A similar statement regarding tidal streams, in accordance with procedure contained in § 129. If no observations have been obtained this is to be stated.
- (x) A statement of positions, if any, at which special current observations (not included under (ix) ) have been obtained.
- (xi) Any additional remarks considered necessary, such as the general quality of bottom.

**148. The plotting sheet.**—This is to be most carefully handled, so as to prevent distortion, and must either be kept flat or rolled. It is not required in the Hydrographic Department, so that on acknowledgment of the receipt of the fair chart it can be destroyed if no longer likely to be required.

**149. Lettering of triangulation stations.**—The distinguishing letters against main triangulation stations if inserted on the fair chart, must correspond to those in the triangulation data forwarded. (See §§ 61 and 143.)

**150. Fair tracings.**—Paper tracings are always to be used for transferring detail from the field boards to the fair chart, and are to be of moderate size to minimize distortion.

**151. Collector tracing.**—A cloth or Kodatrace tracing is to be used on which to collect all the work done in the course of a survey the points being pricked through from the plotting sheet.

Where Kodatrace is used, the edges should be bound since this material tears almost as easily as tracing paper. It should be noted that the matt, not the glossy side should be used.

The work of the survey is to be put on this tracing from time to time, and it thus constitutes a valuable record of what has been done and is a good guide to the progress of the survey.

A cloth tracing must not be used for the purpose of transferring points or other information as it is extremely liable to distortion.

Before the fair chart is forwarded to the Hydrographic Department it must be carefully checked with the collector to see that the two documents are in complete agreement.



On receipt of the acknowledgment of the fair chart by the Hydrographic Department, the collector is to be forwarded to that department unless it is likely to be required in the ship, in which case it may be retained, but it should be forwarded after it is finished with.

When fair charts are being drawn, care is to be taken that the collector and fair tracings are never left in the drawing office at the same time, this is especially important during the night time or the dockyard silent hours, as in the event of a fire occurring in or near the drawing office, there would be grave risk of losing all records of the survey.

**152. Pricking through tracing.**—A paper tracing is always to be used for transferring points from the plotting sheet to the field boards; and it must be carefully handled to prevent distortion.

**153. Tracing of objects controlling the Survey.**—A tracing is to be forwarded, with the results of every survey rendered, showing every mark used for fixing soundings and other details. The names actually used and written up in notation of fixes, in Field and Sounding books, are to be shown. The object of this tracing is to facilitate re-plotting when this has to be done in the Department.

The need to show all surveying names of marks on a record sent to office should not be taken to impose any restriction on the customary free imagination shown by officers in such appellations.

**154. Tracings forwarded to the Hydrographic Department.**—Results of surveys rendered on tracings are invariably to be on tracing paper or Kodatrace. The size is not to exceed 40 inches by 27 inches and the tracing need not embrace all the points used in the survey.

Tracings are normally to carry a graduation. If this is not done, and particularly in the case of large tracings, where there may be distortion, the necessary data for plotting sufficient points is to be given on the tracing unless such data is definitely known to be available in the Hydrographic Department, in which case a reference to the relevant document will suffice.

Tracings are to be bound with tape by the machine supplied and carefully packed for transmission.

Tracing cloth is only to be used for diagrams of triangulation, areas swept, areas surveyed, etc.

**155. Views.**—(a) Views are to be forwarded on unbacked plain drawing paper, without any limit as to size, and as a general rule the drawing paper in the Surveying Sketch Book (H.—12) is to be used for the purpose. The squared paper in the Surveying Sketch Book is to be used only for making the original drawings, which are to include all angles obtained, and are to be forwarded to the Hydrographic Department with Field Books, etc., on completion of surveys.

(b) Such views as appear likely to be of value to Charts or Sailing Directions are to be re-drawn on plain paper in a form suitable for photographic reproduction, and forwarded with the appropriate fair charts, care being taken that the views are not folded.

(c) Any line drawn on a view sheet from an object to its name in the margin for purposes of identification should only be in pencil.

(d) Views are to be pen drawings in indian ink for the outlines and detail, in which very fine lines are to be avoided. Shading to indicate differences of distance, form of hills, etc., may be either by pen work or a sepia wash, the writing indicating leading marks, hills, or other special features being in red.

**156. Photographs.**—When photographs are forwarded they are not to be mounted, but are to be attached to sheets of cartridge paper by means of slits cut in the paper.

No writing of any description is to appear on the face of the photograph, necessary remarks being written on the paper surrounding it. If more than one photograph is forwarded, the prints are to be numbered on the back to facilitate identification in the event of their becoming inadvertently detached from the cartridge paper.

**157. Borders.**—All ungraduated fair charts and tracings, and all views and diagrammatic drawings sent to the Hydrographic Department are to be surrounded by a plain border, and no work, writing, or remarks of any description are to appear outside this framework. In the case of graduated charts or tracings, no work, etc., is to appear outside the *inner* border.

**158. General.**—All drawings forwarded to the Hydrographic Department are to bear the name of the Surveyor who draughted them, at the bottom left-hand corner inside the outer margin. The approval of the Officer-in-Charge of the survey is to be given in a convenient place on the body of the work.

Scales are to be inserted on all charts or tracings which are either ungraduated, or of a scale of 1/25,000 or greater.

## SECTION V.

## CORRESPONDENCE AND RETURNS.

**159. General Remarks.**—From the uncertainty of the weather and other causes much latitude is of necessity allowed to Surveyors in the arrangement of their work, as well as in the time taken for executing it, and from the nature of things it is difficult to predict closely in the Hydrographic Department what progress will be made. It is therefore all the more important that the Hydrographer be kept informed of the *actual progress* of the survey and of proposed movements.

In letters and reports care should be taken to use only such names as appear on the published charts, and when none are available either to give the latitude and longitude of the places referred to, or a reference to some position already established which can be identified at the Admiralty.

In correspondence with the Hydrographer, all communications are to be typewritten on foolscap or demi-quarto paper: demi-quarto paper being always used for semi-official correspondence. In all official correspondence only one side of the paper is to be written upon; only reports, etc., which extend beyond one page are to be rendered in duplicate.

The rule of writing separate letters on different subjects is to be most strictly adhered to.

All official communications addressed to the Hydrographer are to be given registration numbers: references to previous correspondence must always be quoted.

Headed sheets (as shown below) are to be used for all normal correspondence with the Hydrographer. Formal letters with ceremonial preamble and conclusion, are not required.

Specimen of Headed sheet.

From.....Commanding Officer, H.M.S.

At..... Portsmouth.

Date.....

to.....The Hydrographer.

Subject..... Reference Number.....

Former.....

The Hydrographer should be corresponded with direct on all matters affecting:—

- (a) Hydrographic Instructions. All technical questions relating thereto; reports on surveying operations, etc.
- (b) Surveying personnel, officers and men, technical reports, etc.
- (c) Letters of Proceedings. (Copy to Commanders-in-Chief.)
- (d) Supply, etc., of hydrographic instruments and stores.
- (e) H. returns and certain S. forms (Observations for Variation, etc.), Quarterly statements of surveying pay.
- (f) Semi-official letters.

In all other cases correspondence is to be conducted through the usual Service channels.

(SO 7226)

The following are *not* required :—

- (i) Copies of Defect Lists and Lists of Alterations and Additions.
- (ii) Copies of correspondence with Commanders-in-Chief, regarding extra leave, hard-lying allowances, refits, etc., which will in the normal course be referred to the Secretary of the Admiralty for decision.
- (iii) Correspondence regarding drafting of Recorders, except as laid down in § 188.

**160. Semi-official letters.**—The Hydrographer attaches great importance to semi-official letters from officers in charge of surveys, as a means whereby the writer can communicate more freely and in detail than when writing officially, but it must be clearly understood that these cannot take the place of regular reports rendered in the usual service manner and that matters which are likely to require official action must, whether referred to in a semi-official letter or not, form the subject of a separate official letter. It cannot be over-emphasised that official action cannot be taken on semi-official letters, nor may these be quoted as authority for official action on the part of the surveyor afloat.

**161. General account of proceedings.**—A letter of proceedings is to be forwarded to the Hydrographer at the end of each month, from the Officers in Charge of both Home and Foreign Surveys. Each letter of proceedings is to furnish a narrative of the ships' movements and of occurrences worthy of notice during the period under report, comment briefly on the progress of the surveying work, and state the projected movements of the ship. The dates on which surveying officers or recorders join the ship or on which they are discharged are to be included in the letter.

These letters are to be subdivided into appropriate numbered paragraphs and if any subjects are mentioned of which reports have been, or are about to be made, the fact is to be stated and a reference given to the report concerned; allusion should also be made when any searches ordered to be undertaken on passage or when visits to places named in the Hydrographic Instructions for the Survey have for any cause been omitted.

In Home Surveys, the base from which it is proposed to conduct each individual survey is to be stated and any radical alteration in the projected movements as stated in the letters of proceedings is to be reported at once by letter.

The letters should include a list of correspondence forwarded to or received from the Hydrographer.

Letters of proceedings are circulated inside the Hydrographic Department for information only, and it is emphasised that anything in the nature of a detailed report, or which demands action on the part of the Hydrographic Department, must be dealt with by separate letter.

Copies of letters of proceedings are invariably to be sent to the Commander-in-Chief on Foreign Stations, as well as to any appropriate local S.N.O's. In the case of Home ships, copies are to be sent to the Commander-in-Chief of the vessel's Home Port, as well as to the responsible authority of the actual area in which the ship is working.

**162. Programme of future movements.**—Upon receipt of Hydrographic Instructions, a programme of future movements is to be submitted to the Commander-in-Chief or Senior Naval Officer, a copy being forwarded to Hydrographer.

**163. Correspondence with Commanders-in-Chief, etc.**—Copies of important correspondence with Commanders-in-Chief or Senior Naval Officers affecting surveys or programmes of future movements are to be forwarded to the Hydrographer.

Copies of correspondence regarding leave, allowances, refits, etc., which will eventually be referred by these authorities to the Secretary of the Admiralty are *not* required.

**164. Correspondence with Local Surveying Authorities.**—Copies of all important correspondence with local Surveying Authorities regarding triangulation, surveys, etc., are to be forwarded to the Hydrographer.

**165. Reports on searches for shoals, new dangers, etc.**—Every item of information in these reports is carefully considered in the Hydrographic Department and the fullest details of the circumstances and conditions under which the search was made is to be given. Whenever a new danger or feature of navigational importance is found, information is at once to be sent to the Commander-in-Chief of the station, the Senior Naval Officer in port or in the vicinity, the local port or harbour authority, the principal Marine authority of any British Dominion or Colony affected, as well as to the Hydrographer, in advance of the full sailing directions or finished chart. This information is to be sent by telegram if considered necessary, and is to be confirmed by letter or Hydrographic Note.

Such reports cannot be considered complete unless an opinion is expressed regarding the success or failure of the operations, and the existence or otherwise of the shoal, etc. All such reports are to be forwarded as soon as possible after the completion of the work.

**166. Hydrographic instructions.**—Hydrographic Instructions are forwarded to ships at the commencement of each surveying season under cover of a letter termed "General Instructions." They are numbered consecutively for each season, and are always to be referred to by their consecutive numbers. Any additional Hydrographic Instructions issued during the course of a season are forwarded under cover of a reference sheet, and take the next consecutive number.

The "General Instructions" referred to above cancel all existing Hydrographic Instructions and commence a new series.

Hydrographic Instructions will normally contain at the end, in brackets, a reference to the departmental papers on the subject, *e.g.*, (H. 1308/44). This number is invariably to be quoted in subsequent reports in order to facilitate attachment of formers in the Department.

**167. Promulgation of Amendments to General Instructions for Hydrographic Surveyors.**—Additions or corrections to General Instructions for Hydrographic Surveyors will normally be first promulgated by means of the Surveying Ships Orders (short title S.S.O.); being subsequently embodied annually in the book by means of numbered correction slips.

**168. Demands for supply of documents from Hydrographic Department.**—In all cases in which reproductions of charts, maps, triangulation sheets or other data are required for the prosecution of surveys, application is invariably to be made to the Hydrographic Department officially, in writing. Such written requisition is to be made even in cases where verbal requests have already been made.

**169. Advice of documents, instruments, special surveying stores, etc., forwarded.**—When forwarding articles to the Hydrographic Department a covering letter is to be sent containing the following information ;—

- (a) Date of despatch.
- (b) Means of transport.
- (c) How packed.
- (d) Probable date of arrival in England.

In the case of heavy, bulky or valuable packages, which it is not considered desirable to send through the post, the Naval Store Officer should be requested to arrange transport and when this is done, the Hydrographer is to be so informed.

**170. Returns.**—The undermentioned returns are to be rendered periodically or occasionally, as indicated by the letters in brackets in column 3, which represent :—

- (a) Annually ; to reach the Hydrographer by 20th January.
- (b) Half-yearly ; to reach Hydrographer by 20th January and 20th July.
- (c) Quarterly.
- (d) Monthly.
- (e) Under supersession of the Commanding Officer.
- (f) Upon supersession of the Officer in charge of Stores.
- (g) Upon supersession of the Accounting Officer.
- (h) Upon discharge of the Surveying Assistant, or Recorder.
- (i) Upon paying off (*not* upon recommissioning).
- (j) As required.

Full instructions are contained in the paragraphs enumerated in column 4.

No. of form.	Title.	When to be rendered.	Remarks.
H. 1	Qualifications of Surveying Records ..	(a), (e), (h), (i)	See § 186.
H. 19	Qualifications of Assistant Surveyors below the grade of First Class ..	(b), (e), (h), (i)	See § 182.
H. 68	Return of Survey, together with ..	(a), (i)	See § 172.
—	Tracings of areas surveyed ..	(a), (i)	See § 171.
H. 77	Hydrographic Instrument Account ..	(a), (e), (i)	See § 8.
H. 97	Return of Books of reference ..	(a), (i)	See §§ 47, 48.
H. 99	Surveying Contingent Account ..	(a), (g), (i)	See § 173.
H. 100	Oceanographical Stores Account ..	(a), (e), (i)	See § 22.
H. 125	Special Surveying Stores Account ..	(a), (f), (i)	See § 13.
S. 374A	Magnetic variation obtained afloat ..	(j)	See § 95.
H. 395	Hydrographic Note ..	(j)	See §§ 32(g), 59.
H. 394	Return of chronometers and watches ..	(a)	See K.R. & A1, Article 1193.
MS.	Return of Original Documents ..	(a), (i)	See § 49.
MS.	Qualifications of First Class Assistant Surveyors ..	(a), (e), (h), (i)	See § 182.
MS.	Report on newly joined Assistant Surveyors ..	3 months after joining	See § 182.
MS.	Statement of Surveying Pay ..	(c), (i)	See § 175.

**171. Tracings of areas surveyed.**—Tracings showing areas sounded and coastline surveyed during the active surveying season are to be forwarded immediately on arrival at refitting ports for the lie-up season.

These will be attached to Form H.—68 (Returns of Survey) when the latter are received at the end of the year.

**172.—Return of survey (Form H.—68).**—Sundays and Summer Leave periods are not to be included in the total number of working days quoted in this return. Time on passage is not to be included, except for days on which active surveying work is carried out. The number of days spent on passage which are not included in the total number of working days is to be stated separately.

Attention is particularly directed to para. 13 of the form, regarding the localities on the station which appear to require attention for survey. It is considered that the opinions of officers in charge on this matter should be of distinct value. (*See also § 58.*)

**173. Surveying Contingent Account.**—The Surveying Contingent Account is to include all extraordinary expenses, beyond those provided for by the King's Regulations and Admiralty Instructions, which are incurred directly for surveying purposes and are chargeable to the Surveying Vote, such as interpreters' wages, minor repairs to surveying instruments, purchase of batteries, and any necessary purchase of stores or minor expenses incidental to surveying, such as rewards to fishermen or others for information leading to the discovery of rocks.

It should be noted that the following items among others are *not* to be included in the Surveying Contingent Account, but in the main Cash Account of the ship :—

Purchase of and repairs to Naval Stores, including Echo Sounding Gear.

Provisions and Water, including conveyance of these.

Subsistence (Meals, Board and Lodging).

Travelling Expenses (these should be dealt with in accordance with K.R. & A.I.).

Pilotage.

Compensation for damage.

Telephone calls.

Telegrams.

Wireless Messages.

Petrol and Oil.

Hospital Transport.

Stationery (including Repairs to Typewriters).

All items of expenditure which come into the Surveying Contingent Account are to be reported on Form H.—99 rendered to the Hydrographer. The fullest explanation of the reasons for the expense are to be given on this return so that the Hydrographer may be in a position to approve of the payments, and explain the action of the surveyor in the matter if questions are raised. Such expenditure is for the Hydrographer alone to approve and is not to be included in the monthly "Return of Payments" not directly authorised, Form S.—164, sent to the Commander-in-Chief.

All instruments or stores purchased must be taken on charge in the appropriate accounts, and a notation to the effect that this has been done is to be made in the right-hand column of Form H.—99.

A corresponding statement on Form H.—56 and the sub-vouchers for the information of the Director of Navy Accounts are to accompany the cash account; but so far as Surveying expenses are concerned, no explanations of the reason for purchase are to be stated as they are liable to be misunderstood by persons unfamiliar with the Surveying Service. The Hydrographer can supply any necessary information provided Form H.—99 has been correctly rendered. Except in exceptional circumstances, the prior approval of the Hydrographer is to be obtained for items exceeding £25.

**174. Pilotage.**—Surveying officers, whether in appointments carrying surveying pay or not, may submit claims for pilotage under the general conditions of O.U. 5254/38 when they are engaged on ordinary navigation between ports or between a port and the surveying ground.

Claims are not to be submitted for pilotage in an area which is being surveyed, *e.g.*, a ship surveying a part of the Thames Estuary would not be entitled in respect of movements in the estuary necessitated by her surveying activities.

· Claims should be forwarded to the Director of Navigation on Form S. 454.

**175. Quarterly statements of surveying pay, etc.**—In order to facilitate the accounting and estimating of expenditure under Vote 6, a statement is to be furnished to the Hydrographer at the end of each quarter showing, for that quarter :—

- (a) Total amount of surveying pay paid to each Officer.
- (b) Total amount of surveying recorders' pay paid to each recorder.



## SECTION VI. SURVEYING ASSISTANTS.

**176. General remarks.**—On joining the Surveying Service, the attention of Officers is at once to be drawn to the "General Instructions for Hydrographic Surveyors" and the "Manual of Hydrographic Surveying," and they are to be advised to study these and other books on surveying supplied with the surveying library. (*See* § 46.)

Assistant Surveyors will be placed on the list of paid assistants (4th class), from the date of joining.

**177. Training and advancement.**—It is an essential part of the duty of an officer in charge of a survey to instruct the Assistant Surveyors of his staff, to encourage them to keep note books and not to leave them to pick the work up as best they may.

Commanding Officers should endeavour to provide their officers with opportunities for obtaining the necessary all-round experience for each class of assistant surveyor, without which no recommendation for advancement should be made, unless under special circumstances, in which case, the lack of experience under any heading is to be explained.

The advancement of assistant surveyors depends on the experience gained and the special aptitude shown by each individual, combined with the degree of reliability to be placed on his work. Although zeal and good conduct should be taken into consideration these alone do not constitute a sufficient justification for advancement without the necessary qualifications in knowledge.

The normal minimum periods in each grade before advancement are as follows:—

As 4th Class Assistant Surveyor	...	...	...	1½ years.
„ 3rd „ „ „	...	...	...	2½ „
„ 2nd „ „ „	...	...	...	3 „

Advancement before the completion of the above periods will only be made in cases where a special recommendation for accelerated advancement is specifically included in the report from the Commanding Officer.

On recommending an officer for advancement to Assistant Surveyor, 1st class, the column of the report under the heading General Remarks, is to contain a particularly full statement of the grounds on which the recommendation is based. Such advancement will only be granted to officers whose professional knowledge and experience fit them to direct efficiently the operations of a survey in the temporary absence of the Captain, and who are competent to take sole charge of a survey. These reports must therefore deal fully with the officer's attainments, zeal, initiative and administrative ability.

It is considered neither necessary nor desirable to hold any formal examination; opportunities occur almost daily of testing the knowledge and proficiency of an officer in any particular subject.

With a view to ensuring that recommendations for advancement are based upon an uniform system, and to serve as a guide regarding the various branches of the subject with which officers are expected to be familiar before being recommended for advancement, the ability of Assistant Surveyors should be considered with reference to the following details, and the officer to be recommended should have a good knowledge and sufficient experience according to the class for which he is recommended.

## (a) FOR ASSISTANT SURVEYOR, 3RD CLASS.

- (i) Sextant.—Errors and adjustments.
- (ii) Theodolite.—Adjustments.  
Methods of observing and ability to observe.  
Topographical sketching.  
Observations for true bearing of sun.  
Levelling.  
Heights.
- (iii) Helio-stat.—Use of Galton and other sun signals.
- (iv) Fixing Position.—Principles involved in the resection and intersection of a point.
- (v) Boat Sounding.—General skill, thoroughness and reliability.  
Ability to plan lines of soundings.  
Effect of error in lead line.  
Use of echo and wire sounding machines.
- (vi) Skill in obtaining beach gradients.
- (vii) Rigging and operation of the various boat sweeping arrangements, danbuoys and current logs other than the Wollaston current meter.
- (viii) Coastline.—Skill in delineating the features of a coast.  
Skill in depicting the topographical features bordering a coast.  
Accuracy and quickness of work.  
Skill in sketching coastline from a boat.  
Determination of heights along the shore line.
- (ix) Subtense methods including the use of tacheometers and 10-foot pole.
- (x) Marking the coast.—Skill in selecting proper positions for marks, and in choosing suitable objects by which to fix them.  
Knowledge of the principles involved in fixing coast marks.  
Celerity and resource in putting up marks with material at hand.
- (xi) Bases.—Masthead angle base from two stations.  
Measuring a base and correcting it.  
Base by astronomical observations.
- (xii) Astronomical observations at sea.
- (xiii) Comparing chronometers.—Ability to obtain W/T time signals.
- (xiv) False stations.—Knowledge of the principles upon which the correction is made and how to minimize it.  
Facility shown in correcting angles.
- (xv) Handling boats.—Judgment and skill under difficult conditions of weather, landing, tidal influence, etc.
- (xvi) Ship sounding.
- (xvii) Deep sea sounding.
- (xviii) Draughtsmanship.—Neatness.  
Squaring down from larger scales.
- (xix) Knowledge of horizontal and subtended angle at the same or different elevations, and how to correct to the horizontal.
- (xx) Knowledge of co-ordinates and their use and the simple calculations concerned therewith.
- (xxi) Principles of Plotting and computations.

**(b) FOR ASSISTANT SURVEYOR, 2ND CLASS.**

In addition to the foregoing, an officer should have adequate knowledge and experience of the following subjects :—

- (i) Tides.—Determining datums.
  - Referring one tide gauge to another in places where establishment and range differ.
  - Familiarity with the Tidal Returns and information required by the Hydrographic Department.
  - Knowledge of the inferences to be drawn from the position of the sun and moon.
  - Precautions necessary in establishing a tidal station.
  - Knowledge of tidal stream and current observations and methods of rendering reports on them.
- (ii) Topography.—Skill in sketching topography by walking over the ground. Plane tabling.
  - Skill in sketching topography from ship or boat.
- (iii) Star observations.—Ability to prepare lists of stars, and to observe for geographical position with theodolite and prismatic astrolabe.
  - Observations for true bearing of a star.
- (iv) Convergency of meridians.—Familiarity with the subject and appreciation of the various ways and circumstances in which convergency has to be taken into account.
- (v) Plotting.—Ability to plot all the points of any plan.
  - Full knowledge of the use of co-ordinates.
- (vi) Survey of a river.
- (vii) Ability to frame Hydrographic Notes.
- (viii) Sound knowledge of all types of Echo Sounding Gear.
- (ix) Chronograph.—Full knowledge of the use, etc., of the electric chronograph and its accompanying adjuncts.
- (x) Knowledge of taut wire gear.
- (xi) General knowledge of sweeping gears including the use of Asdic.
- (xii) Ability to organise and operate detached surveying parties.
- (xiii) Knowledge of W/T receiving sets and ability to obtain Rhythmic Time signals.
- (xiv) Knowledge of the "Woolaston" current meter.

**(c) FOR ASSISTANT SURVEYOR, 1ST CLASS.**

An officer should be thoroughly experienced in the whole of the foregoing, should be capable of conducting a survey independently and possess the following qualifications :—

- (i) Running surveys.—Familiarity with the methods of securing the best results from angles taken from a position not absolutely stationary, by the selection of suitable zeros, etc., and the principle on which such practice depends.
- (ii) Floating beacon surveys, the methods and refinements of which they are capable.
- (iii) Thorough knowledge of how to construct a coast survey without the use of a linear base, and use of taut wire base, in this connection.

- (iv) **Triangulation.**—Quickness of apprehension in selecting most suitable spots for main and secondary stations, and ability to build up a comprehensive triangulation scheme for coast survey of large extent.
- (v) Calculation of an extended triangulation, including the calculation of astronomical positions, treating the earth as a spheroid.
- (vi) Plotting and graduation of charts of all sizes.
- (vii) Knowledge of the more common projections in use throughout the world.
- (viii) Ability to frame concise Sailing Directions.
- (ix) Knowledge of the errors involved by the deflection of the plumb line.
- (x) Ability to deal with difficult problems in practical surveying as they arise, by the display of initiative, and capacity to devise methods suitable to particular cases.
- (xi) Knowledge of simple, graphical methods of plotting topography from air photographs.
- (xii) **Sweeping.**—Thorough knowledge of the methods adopted for sweeping for rocks or other obstructions.  
Streaming and recovering a sweep, and a thorough knowledge of the gear.
- (xiii) Knowledge of the rigging of the various types of surveying beacons.
- (xiv) Knowledge of all oceanographical equipment and the method of rendering observations.
- (xv) Application of Radar to Hydrographic Surveying.
- (xvi) General knowledge of the methods of Chart Production.

In addition to the above details, all Assistant Surveyors are expected to have a knowledge of meteorology commensurate with their service.

**178. Meteorological courses.**—The study of meteorology is an important duty of Commanding Officers and Assistant Surveyors.

In the normal course, Surveying Officers are appointed early in their careers to undergo one week's course in the Naval Meteorological Branch. Officers who are reported on satisfactorily at the conclusion of the course may, if circumstances permit, take a further twelve weeks' course.

All arrangements in connection with these courses are normally initiated by the Hydrographer, and Commanding Officers are to bring to his notice the name of any officer showing special aptitude for meteorological work.

Surveying Officers who have taken a course of three months are to be given facilities at regular intervals to visit the Naval Meteorological Branch for one or two days at a time in order to discuss their problems with the naval staff; applications for such visits should be submitted to the Hydrographer as necessary.

On commissioning, or as soon as can be arranged, one officer from each Surveying Ship is to undergo a one or two day meteorological course in the Naval Meteorological Branch, in accordance with A.F.O. 5373/42.

In the case of a ship proceeding to a foreign station the course will be extended to six days.

**179. Gyro compass courses.**—All Surveying Assistants are required to take a course of instruction in Gyro Compass at the Compass Observatory, Slough, at the first convenient opportunity after joining. All arrangements in connection with these courses are initiated by the Hydrographer.

**180.—Echo sounding courses.**—Special courses in Echo Sounding Gear are occasionally arranged and are held at Portland.

Applications to undergo such courses should be forwarded by the Commanding officers concerned if and when occasion arises.

**181. Air Survey courses.**—Special courses in surveying from air photographs are occasionally arranged.

Applications to undergo such courses should be forwarded by Commanding Officers as occasion arises.

**182. Reports.**—Commanding Officers are to furnish manuscript reports on the zeal and general usefulness of newly joined officers three months from the date of joining, or as soon after as they have had sufficient opportunity to form an opinion; if considered unsuitable for the Surveying Service the fact is to be reported and reasons stated.

Reports on Form H.—19 are to be rendered half-yearly to reach the Hydrographer by the 20th January and 20th July, stating the qualifications of each Surveying Officer below the grade of 1st Class Assistant, which will enable the various claims to advancement to be considered together, and furnish the Hydrographer with a record of each officer's progress. An annual manuscript report is to be made on each Assistant Surveyor, 1st Class, in which is to be included the Commanding Officer's opinion of the officer's fitness for command. In making this report it is to be remembered that the selection of Commanding Officers for surveying ships requires most careful consideration, not only on account of special knowledge of hydrography, but also with regard to temperament, seamanship, organising ability and initiative; the more detailed the reports, the less difficulty there should be in selecting the most suitable officer, and it should be borne in mind that the Hydrographer is largely, if not entirely, dependent on the reports of Commanding Officers for his knowledge of the professional ability of all surveying officers who are not in actual command.

Similar reports are also to be rendered on the occasion of the supersession of the Commanding Officer or the discharge of the officer concerned.

Reports are not required in the case of officers who have been less than three months under the command of the reporting officer.

**183. Commissioned Non-Executive Officers.**—Facilities may be given to these officers if desired, while employed in surveying ships, for making themselves acquainted with a Surveyor's duties. They may, if recommended, when considered proficient, be granted pay as an Assistant Surveyor, whilst actually, and continuously employed on the surveying ground. Such recommendation should be made to the Hydrographer in the usual manner.

## SECTION VII.

## SURVEYING RATINGS.

**184. General remarks.**—Surveying Recorders form part of the authorised complements of Surveying Ships. Five recorders are allowed in the complement of each Surveying Ship employed in home waters and six in each ship employed abroad. The qualifications necessary for the three classes are given in K.R. & A.I., Appendix XII, Part 25, and details of allowances payable, conditions of employment, etc., will be found in Appendix XVII, Part 3 (108).

The Hydrographer advises the Commodore, R.N. Barracks, Chatham, and the Surveying Ship concerned, of each case in which the payment of an increased allowance is authorised.

Payment of allowances or alterations in rates should not be made without the Hydrographer's authority.

**185. Training and advancement.**—(a) Commanding Officers should encourage volunteers to qualify for the rating of Surveying Recorder, and should arrange instruction when required. Qualified Recorders should be encouraged to try to pass for the higher classes.

(b) Names of men first qualifying for this rating are to be reported to the Hydrographer, who, if he approves their addition to the Roster, will inform the Commodore, R.N. Barracks, Chatham, and the ship concerned. Reports are similarly to be forwarded to the Hydrographer when Recorders qualify for advancement in class. Commanding Officers are not to make these reports direct to the Commodore. The dates of qualification for each class are to be inserted on service certificates and reported to the Hydrographer.

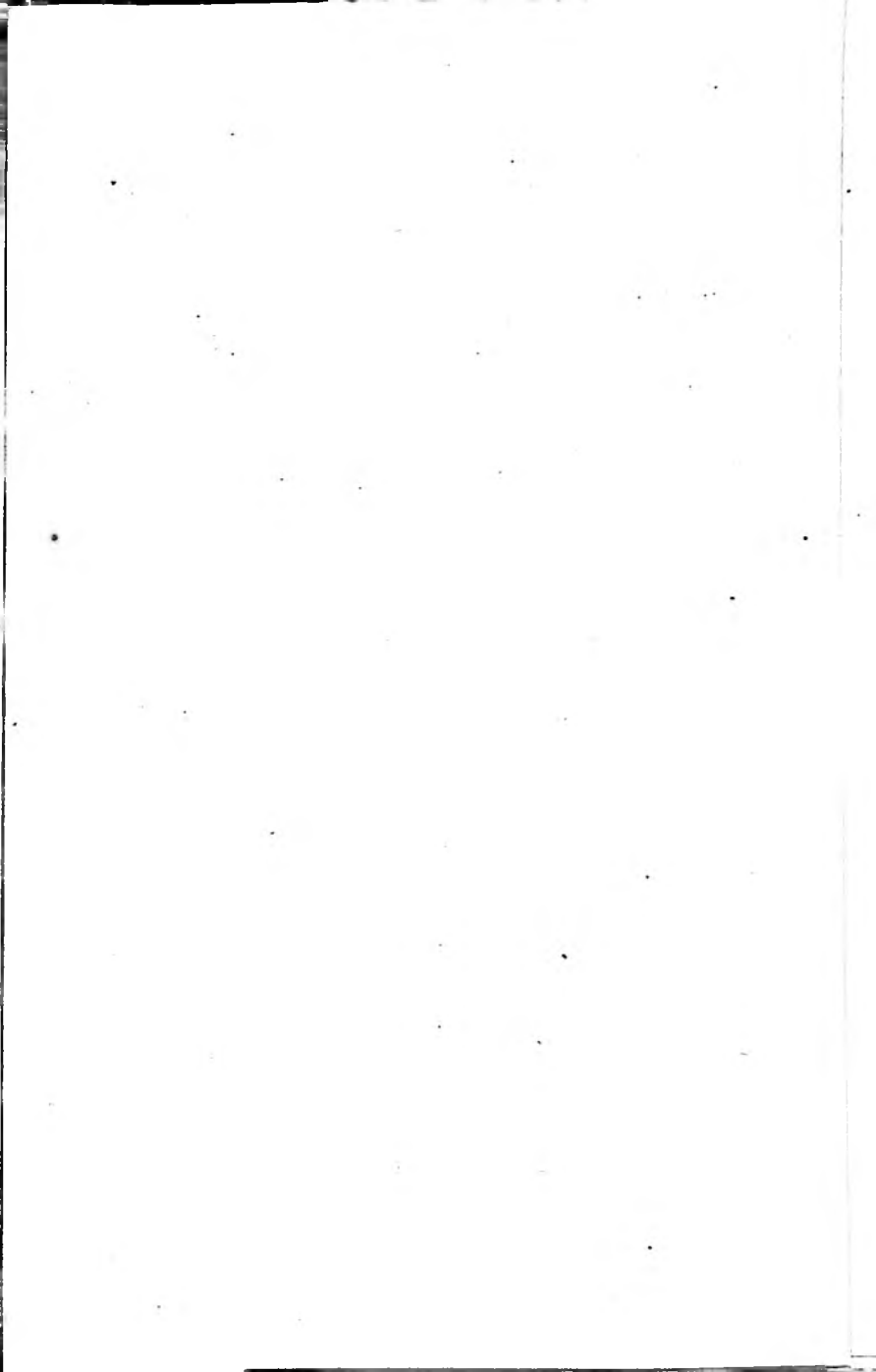
(c) Second and third class Surveying Recorders are to be examined for advancement in class at the expiration of two years' paid employment in their existing grades; the result of such examination is to be reported to the Hydrographer and included in the next return on form H.—1. Should a Recorder not desire to be examined, the fact is to be reported.

**186. Reports on Qualifications.**—Reports on Form H.—1 on the qualifications of paid Recorders are to be rendered annually, and also on the supersession of the Commanding Officer or discharge of the Recorder. Should a Recorder have been less than three months in the ship, Form H.—1 is still to be rendered with "less than three months in the ship" inserted in the Report space.

**187.—Drafting of Recorders.**—(a) Arrangements to draft Recorders to Surveying Ships, on commissioning, re-commissioning, or completing to full complement, are made by the three Home Depots in accordance with the authorised complement and under the ordinary drafting regulations.

(b) When vacancies for Recorders arise during a commission, they are to be automatically filled by unpaid qualified Recorders, if any of such are borne, and the fact reported to the Hydrographer. If no unpaid qualified Recorders are borne, Commanding Officers should demand reliefs in the same way as for other ratings.

(c) Should any of the ports not have Recorders available to meet requirements at any time, the other ports will be consulted in order to supply the requisite number, if available, and in the event of none being available at any of the ports, the depot to which the Surveying Ship is attached will report the facts to the Admiralty for further action if considered necessary.



## GENERAL INSTRUCTIONS FOR HYDROGRAPHIC SURVEYORS

## Section VII.

## SURVEYING RECORDERS

Para.184. General Remarks. Attention is called to A.F.O.162/49. Surveying Recorder is a Specialist Qualification in the Seaman Branch, and the surveying recorder qualification is open to seamen under the same regulations as apply to other technical branches.

No specialist qualification additional to S.R.I is required for advancement to Chief Petty Officer.

Promotion to Branch Officer is open to surveying recorder ratings in the same way as in other technical branches.

Surveying Recorders form part of the authorised complements of surveying ships as follows:-

				Total
Dampier Class	3 S.R.I	4 S.R.II	9 S.R.III	16
Halcyon Class & Challenger	2 S.R.I	3 S.R.II	7 S.R.III	12
S.M.Ls.		1 S.R.II	1 S.R.III	2
Surveying Training Unit	2 S.R.I. or 2 S.R.II			2

The qualifications necessary for the three classes of surveying recorder are given in K.R. & A.I., Appendix XII, Part 25.

Para.185. Training and Advancement. A Surveying Recorder Training Unit is established in R.N.B. Chatham, in the charge of a Surveying Officer under the direction of the Commodore, R.N.B.

A roster of volunteers (from all Port Divisions) for S.R.III training is kept at Chatham. The training of ratings available in the United Kingdom for S.R.III is carried out there. Short courses for S.R.Is and IIs will be available at Chatham for ratings serving in the United Kingdom, when opportunity will be taken to instruct ratings in the use of instruments and stores not normally carried by Home Surveying ships.

For the time being training for all classes of S.R. will also continue to be carried out on board surveying vessels abroad, and for S.R.I and S.R.II on board surveying ships at Home.

Recommendations for Surveying Coxswain, S.R.I, S.R.II and S.R.III on Form S.1303 are to be sent to the Officer in Charge, Surveying Recorder Training Unit, R.N. Barracks, Chatham, for onward transmission to the Commodore of the rating's own depot. Separate Forms S.1303 are to be used for ratings belonging to different port divisions. Commencement of training for S.R.III or higher grades should await the approval of Commodore, Chatham. Before a man is recommended for S.R.III training he is to have his eyesight re-tested and must attain Naval Eyesight Standard I; see A.F.O.2708/48.



A normal minimum of two years service in each grade is required, and the Specialist Qualification may not be more than one higher than the corresponding rate held. As a temporary measure, however, to meet the present exceptional circumstances, the minimum period of two years service may be reduced for specially recommended ratings as follows:- C.P.O. and P.O. may qualify as S.R.I, and Leading Seamen as S.R.II after one years service as S.R.II or S.R.III respectively.

When S.R.III training is confined to a ship, six months under active surveying conditions should be sufficient for a man to reach S.R.III standard. The Commanding Officer should then be in a position either to qualify a rating for S.R.III or to report that he is unsuitable. Unless therefore there are some exceptional circumstances action should be taken accordingly.

Names of men passing qualifying examinations in ships for S.R.I, II or III should be reported on Form H.1 to the Commodore, Chatham, who will give approval for qualification, but Commanding Officers in surveying ships on Foreign Stations may qualify ratings to fill vacancies in complement.

Forms S.161 reporting changes of engagement, rating, and specialist qualification etc., and Forms S.543 reporting movements, are to be rendered as usual to the Commodore of the man's depot, but in the case of Portsmouth and Devonport ratings an extra copy is always to be sent to the Commodore, R.N. Barracks, Chatham.

Ratings whose engagement expires within two years of completion of their course should not be trained for S.R.III unless they sign on to complete time for pension.

Para.185. Training Guides. Guides in note form will be issued to Surveying ships and to the Surveying Training Unit, covering the courses for S.R.I, II and III, to ensure standardisation of training.

The Officer in Charge of the Surveying Recorder Training Unit, Chatham, will inform surveying ships from time to time the names and numbers of the latest film strips available for use in surveying training. The strips, and the 16 m.m. still projector required for showing them, are drawn from Naval Stores.

Para.186. Reports and Records. Commanding Officers are required to report to the Commodore, R.N.B., Chatham as follows:-

- (a) By Form H.1 (April 1947) for all surveying recorders borne.
  - (i) On examination for S.R.III or higher grade (or reduction in grade)
  - (ii) Annually on 31st December) Accompanied by a list of
  - (iii) On paying off ) ratings under training
  - ) for S.R.III
  - (iv) On discharge of a recorder or rating under training.
- (b) By reference sheet on 31st March, 30th June, and 30th September, giving a nominal list of S.R. ratings on board including those under training or reported as volunteers.
- (c) By a copy of Form S.161 as required by Article 1730b, K.R. & A.I., the original of this form being forwarded to the Commodore of the rating's depot. A surveying History Sheet S.1245 J is to be raised for a man on qualifying for S.R.III and copies of all

reports forwarded to Commodore Chatham on Form H.1 are to be inserted in the appropriate columns of the History Sheet, which will be retained with the man's Service Documents.

Record Cards, obtainable from the Officer in Charge of the Surveying Recorder Training Unit, Chatham, are to be made out for men qualifying for S.R.III and forwarded to the Commodore, Chatham, where they will be kept up to date from the periodical information forwarded on Forms H.1.

Trade Certificates Form S.1233 W are to be completed for Surveying Recorders leaving the Service in accordance with K.R. & A.I., Art.610.

All correspondence concerning the drafting or specialist training of men holding Surveying Recorder qualifications is to be addressed to the Commodore, R.N. Barracks, Chatham, with a copy in the case of Portsmouth and Devonport ratings to the Commodore concerned.

Para.187. Drafting of Recorders. The Commodore, R.N.B. Chatham, will be responsible for the drafting of all recorders from all Port Divisions.

When paying off a ship, or when for instance a rating is about to complete time for pension, Commanding Officers will discharge Surveying Recorders to their Home Depots in accordance with Drafting Regulations. When a Surveying Recorder has completed his engagement, his civilian address should be forwarded to the Officer-in-Charge, Surveying Training Unit, Chatham, so that he may be contacted if suitable employment in a civilian status is on offer.

Para.188. Employment of S.R.I.s. Commanding Officers are to use their discretion in the extent to which 1st Class Recorders are employed and those who in his opinion have the necessary ability may be entrusted with boat sounding, coastlining and triangulation. It must be remembered, however, that such ratings are not qualified to assume responsibility for work to which no check can readily be applied and certainly not for important details such as the examination of shoals where the safety of navigation is affected. The Commanding Officer must in fact remember his over-riding responsibility.

Para.189. Reduction, Relinquishment, or Cancellation of Specialist Qualification.

The general question of reduction, relinquishment or cancellation of specialist qualifications is dealt with in K.R. & A.I. para.429 and A.P.O. 1514/48.

Cancellation of specialist qualification on the grounds of a man's ignorance of his duties can only apply to the grade of S.R.III and may only be resorted to within two years of his first qualifying.

Para.190. Surveying Coxswain. Chief Petty Officers and Petty Officers of the Surveying Branch will be eligible for appointment as Surveying Coxswain in part complement of surveying ships, and when so appointed will be paid the Special Responsibility Allowance of 1/- a day. See A.P.O.1514/48.

A pre requisite is that ratings should have taken sections (c) and (d) of syllabus for Q.M.1 (A.P.O.1795/47).

If a Petty Officer, the Surveying Coxswain may hold the rating of Acting Chief Petty Officer whilst performing the duties of Coxswain if a note to this effect is included in the scheme of complement.

Reports on Form H.1 are to indicate whether or not an S.R.I is recommended to undertake the Coxswain's Course i.e. sections (c) and (d) of the syllabus for Q.M.1. The Course will be taken at the R.N. Barracks, Chatham and about three weeks will cover the restricted syllabus. The Commodore, Chatham, will, from time to time, arrange courses for selected ratings, preferably from ships during their lie-up periods in Home Waters.

Ratings who qualify will then be available for drafting by Commodore, Chatham, as Surveying Coxswains.



**188. Movements of Recorders.**—It is laid down in K.R. & A.I., Appendix XVII, Part 3 (108), that the Commodore, R.N. Barracks, Chatham, is to be kept informed of all movements of all qualified Recorders, whether paid or unpaid. Copies of such correspondence are to be forwarded to the Hydrographer.

**189. Radar ratings.**—A Radar rating may also be paid as a Surveying Recorder when employed in the dual capacity. This is subject to existing regulations regarding the qualifications required for Surveying Recorders and the number allowed to be borne.

In the case of such ratings, drafting as a Radar rating would take priority so that continuity of employment as a Surveying Recorder is the less likely to be assured.

**190. Surveying Coxswains.**—Men holding the substantive rate of Petty Officer, Leading Seaman or Able Seaman who are selected, on account of their special ability, for employment as Coxswains of Surveying motor boats carried in or attached to Surveying ships, may be paid an allowance of 6d. per diem under the conditions laid down for Category A allowances in K.R. & A.I., Appendix XVII, Part 3.

This allowance is only applicable to coxswains of Surveying motor boats. Smaller boats such as surveying dinghies, even though carrying portable echo sounding equipment, are excluded.

Surveying motor boats in service with Surveying units are to be considered as within the scope of this article.

The allowance is only to be authorised when the rating, whether Petty Officer, Leading Seaman or Able Seaman, is considered competent to carry out the duty. This must apply to Surveying units and the allowance be withheld if the rating drafted as Coxswain, to whom there is no alternative as in a ship, is not fully competent, or until such time as he has been trained.

SECTION VIII.  
MISCELLANEOUS.

**191. Notices to Mariners concerning surveying operations.**—An Admiralty Notice to Mariners detailing the localities in which surveying operations by H.M. Surveying Ships in home waters are being undertaken is issued annually at the commencement of the surveying season. This notice indicates the possibility of the use of unlighted surveying beacons, and no further notices concerning these operations will normally be issued unless lighted beacons are brought into use (*see* § 192). Commanding Officers of surveying ships abroad are to notify the Hydrographic Department well in advance if an Admiralty Notice to Mariners is required in connection with any surveying operations. Admiralty Notices to Mariners will generally be issued only for beacon surveys abroad, except when the survey is in or near the vicinity of a main shipping route. Commanding Officers are responsible for informing all appropriate local authorities when surveys are undertaken abroad irrespectively of whether such information is being promulgated by Admiralty Notices to Mariners or not.

**192. Promulgation of positions of floating beacons.**—When floating beacons are moored off the coast of the British Islands in connection with surveying operations, Commanding Officers are to arrange to keep the local Fishery Officers and the Fishery Cruiser on patrol informed of their positions, with a view to the information of Fishermen when necessary, thus obviating the risk of damage to nets, etc., or alternatively loss of or damage to Government stores. Further, with a view to minimising the risk of loss or damage in traffic areas, consideration should be given to the use of "Rask" lamps in selected positions, and Commanding Officers are to indicate, when rendering reports, which beacons if any, it is proposed to light.

The above information is also to be supplied to the local Commander-in-Chief, and the Hydrographic Department, but an Admiralty Notice to Mariners will not be issued unless it is proposed to light some of the beacons.

On foreign stations, the positions of all floating beacons moored are to be communicated to the Commander-in-Chief and all appropriate local authorities, but they are not required in the Hydrographic Department.

**193. Surveyors' warrants.**—Arrangements have been made with the Ministry of Agriculture and Fisheries for the issue of Surveyors Warrants to surveying officers employed in home waters.

These warrants are for the personal use of the officers whose names appear on them, and are issued as the authority for conducting a search for ordnance survey marks which may be situated on private property or common land. The customary intimation to the owners of property or the Borough Councils, etc., of a desire to occupy an ordnance survey station, is not, on account of the supply of these warrants, to be omitted; but should any difficulty arise in connection with such occupation, the attention of the person concerned may be called to the Authority conveyed by the warrant.

A list of officers holding Surveyors' Warrants is kept in the Hydrographic Department, but Commanding Officers are to forward demands for warrants on each occasion of a new appointment of a Surveying Officer to his ship. In the event of a Surveying Officer being appointed from a home to a foreign surveying ship, or of reverting to General Service, the Surveyors' Warrant is to be returned to his Commanding Officer for transmission to the Hydrographic Department.

**194. Ordnance Survey Marks.**—Particular attention is directed to the instruction that Ordnance Survey marks, when found, are never to be moved or tampered with, and Commanding Officers are responsible that this order is strictly adhered to.

Whenever Ordnance Survey marks are uncovered, the fact is to be reported direct to the Director General of the Ordnance Survey on the special form supplied, copies of which can be obtained from the Hydrographic Department on demand. Should it occur that the description of the position of an Ordnance Survey mark, as supplied by the Ordnance Survey, is found to be inaccurate, either on account of changes in the surroundings or for other reasons, the report is to include full and up-to-date detail and measurements to enable the mark to be readily located.

**195. Co-operation between aircraft and surveying ships.**—When H.M. Surveying Ships are working within reasonable distance of the Fleet Air Arm or an R.A.F. station, if the Officer-in-Charge of the survey considers the assistance of aircraft is likely to be of material assistance, either for obtaining photographs or for reconnaissance purposes, he is to make the necessary arrangements.

If photographic flights can be arranged, as much information as possible should be given to the authorities responsible for ordering the flight. This should take the form of a "brief" on rough lines as follows:—

*Object of the flight.*—To photograph for survey purposes, the area enclosed by .....

*Camera lens and height.*—..... inch lens, at ..... feet, to give a mean photographic scale of 1 : .....

*Flight details.*—Strips to be flown along lines indicated on the accompanying tracing/map/chart. Photograph overlap required—60 per cent. Strip overlap required—25 per cent. Tilts should be kept to a minimum.

*Photographs.*—..... sets required, hand processed to minimise distortion.

Where it is desired that photographs should be taken at a given tide state, recommended times of photography should also be included.

**196. Extra issue of provisions.**—Certain extra provisions are permitted to be issued to H.M. Surveying Ships. The regulations in this connection are contained in the "Manual of Victualling, 1929," Chapter V, Section B, and a list of available provisions will be found in Appendix C of the same volume. Such issued are only to be made by direct authority of the Commanding Officer.

**197. Gratuitous issue of clothing.**—Special gratuitous issues of clothing and blankets are allowed to crews of H.M. Surveying Ships by K.R. & A.I., Article 1876. The regulations in this connection are contained in the "Manual of Victualling, 1929," Chapter XI, Section H.

**198. Rewards to fishermen and others for information leading to the discovery of rocks.**—On coasts where fishermen resort or where there are persons with local knowledge, they should be questioned as to the existence of rocks, and rewards may be given for information leading to the discovery of any rocks previously unmarked on the charts. The amount of such awards, which are chargeable to the Surveying Contingent Account, and which must vary with different circumstances, is left to the discretion of the Officer-in-Charge of Survey.

It is to be clearly understood that rewards are only to be given in cases where, owing to lack of indications in the surrounding depths, shortage of time available, or other reasons, it is reasonable to assume that the rocks would have escaped detection in the absence of the information supplied.

**199. Use of anchor buoys.**—The following precautions are to be taken to minimise the risk of loss of anchors in surveying ships.

In suitable depths, and in anchorages which are not crowded, or in which there is not much traffic, anchor buoys are to be used; when this is not considered possible or desirable a sinker, suitably buoyed, is to be kept on the forecastle ready for immediate use in the event of the cables parting.

**200. Boathook staves.**—On account of ash boathook staves being very much more expensive than fir staves, only the latter are to be used for the purpose of erecting marks, etc. Ash staves are to be reserved for their real purpose, *i.e.*, for use in boats and in special circumstances where a hard wood is necessary.

**201. Signals to be used by surveying ships at anchor in unusual positions.**—The following orders respecting signals to be made use of are to be complied with:—

- (1) When vessels employed by the admiralty on surveying operations are obliged, owing to the special nature of the work, to anchor in unusual positions, *i.e.*, in a fairway, in the vicinity of fishing grounds, etc., they are to make use of the day and night signals, prescribed in Articles 4 (b) and (c) of the Regulations for preventing Collisions at Sea, as authorised for a vessel laying or picking up a telegraph cable.
- (2) With the object of bringing this information to the knowledge of all concerned, Notices to Mariners will be issued from time to time, indicating the positions where surveying vessels will be engaged on special work and that while so employed they may when at anchor, make use of the marks and lights of a telegraph ship (*see* § 191).

It is to be noted that the use of these signals by surveying vessels has not received statutory sanction and it is not to be construed that Articles 4 (b) and (c) of the Collision Regulations have been amended. The signals can only be considered as cautionary, and are only to be employed when absolutely necessary, in the special circumstances mentioned.

**202. Promulgation of information on surveying subjects.**—New ideas or inventions in the field of material, or improvements to existing instruments and appliances, should be brought to the notice of the Hydrographer with a view to the promulgation of such information for the general benefit of the Surveying Service.

Similarly any new ideas in the field of practical or theoretical surveying should be embodied in written reports and submitted for the consideration of the Hydrographer.

**203. Publication of the work of a surveying ship.**—On the publication of a new chart or new edition of a chart embodying extensive corrections from a survey in which the surveying staff of a surveying ship has assisted, assistants who are desirous of receiving complimentary copies will be supplied on demand, such demands being forwarded through Commanding Officers.

In the case of new charts, one complimentary copy will be supplied automatically.

Copies of such charts will also be supplied to Surveying Recorders if required, demands being forwarded through Commanding Officers in all cases.



**204. Messing of Shore Parties.**—Should circumstances arise when arrangements have to be made for a shore party to be messed by a local agent, a written contract must be made and an advertisement issued in the local newspaper in the terms laid down for Officers' Messes in B. R. 97 (Manual for Officers' Stewards).

If local conditions make this advertisement impracticable, a fidelity bond should be obtained from the Agent employed.

**205. Hard Lying Money.**—The conditions governing the payment of Hard Lying Money are contained in K. R. & A. I., Vol. I, Article 1638 (2).

Hard Lying Money is *not* to be paid when ships are refitting or laid up unless the circumstances are exceptional and then only with the prior sanction of the Admiralty.

If, on any occasion of boiler repair, refit, etc., which may necessitate the ship being in Dockyard hands for a considerable period, it is thought right to seek approval for the payment of Hard Lying Money, the circumstances should be represented fully and instructions sought as to whether or not such money is payable.

Particular care is to be taken to comply with the Regulation mentioned above and sanction is *not* to be sought unless it can be wholly justified. In this connection, the reasons for, as well as the conditions for such payment, are to be carefully studied.

**206. Demands for Naval Stores, Echo Sounding Equipment, etc.**—Commanding Officers are advised that when urgent demands are made for items of Naval Stores, etc., a copy should be sent to the Hydrographer.

This Department may well be able to expedite despatch and advise the Department concerned of the reason for urgency as well as the best way of consigning the stores.

**207. Liaison with Civil Engineer-in-Chief.**—The attention of Commanding Officers is drawn to the desirability of maintaining liaison with representatives of the Civil Engineer-in-Chief. Such liaison may often result in the exchange of useful information.

The whereabouts of the Superintending Civil Engineer, or other C. E. in C. representatives should be readily ascertained from local Senior Naval Officers.

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Page 10. Para.4. Losses. delete first paragraph and substitute:-

"Losses of the more important instruments (those bearing H numbers) when either theft or negligence is suspected, are to be reported through Administrative Authorities in accordance with K.R. & A.I., a copy being sent to the Hydrographer with Form H.50.

Losses by accident and damage to such instruments are to be reported direct to Hydrographer with full details and accompanied by Form H.50."

add final paragraph:-

"Whilst the additional handling for surveying purposes of some instruments will be taken into account in the case of loss or damage, surveying personnel must be impressed with their value and must expect any lack of care or proper precautions to be paid for out of the pocket of the individual concerned."

H.4410/49

#### CORRECTIONS TO "GENERAL INSTRUCTIONS FOR HYDROGRAPHIC SURVEYORS (1945)"

##### ERRATA

The following errors appear in the attached list of corrections to "General Instructions for Hydrographic Surveyors (1945)":—

- Page 45. Para. 92. Last paragraph.  
For "Admiralty Manual of Tides, Part III" read  
"Admiralty Tide Tables, Part III."
- Page 47. Para. 96. Last 5 words of new sub-para.  
For "Is recommended in the manual" read  
For "as recommended in the manual".
- Page 70. Para. 171. Correction should read:—  
"171. REPORTS ON SURVEYING MOTOR BOATS. Reports on Surveying Motor-boats or their equipment, including annual reports on echo sounding gear, are always to quote the number of the boat."
- Page 80. Para. 191. Sub-para. 2. For "rembered" read "remembered".
- Page 83. Para. 210. Sub-para. 1.  
For "A.F.O.s 892 and 893 of 1947" read  
"Current A.F.O.s".



delete paragraphs and substitute:-

"Chronometers and watches are supplied to Surveying Ships and Launches in accordance with the following establishment:-

Home ships : 1 Chronometer.                      1 Chronometer watch  
                    1 Deck watch.                      6 wrist watches H.S.9.  
Dashboard watches and brackets - One per Surveying  
Motor Boat and one spare complete.

Ships Abroad : 1 Chronometer.                      3 Chronometer watches.  
                    1 Deck watch.                      10 wrist watches H.S.9.  
Dashboard watches and brackets - one per Surveying  
Motor Boat and one spare complete.  
2 Chronometers (Marine or Field Type) fitted with  
electrical contacts for use with chronograph for  
observations ashore. Rated and compared as B and  
C chronometers in the usual manner.

S.M.L.s :                      1 Deck watch.                      2 wrist watches H.S.9.  
                    1 Dashboard watch and bracket.

South Coast of  
England Survey : 3 wrist watches H.S.9.  
Dashboard watches and brackets - One.

They are not surveying instruments and are on charge to the Navigating Officer. The action to be taken in the case of loss, damage or theft is laid down in K.R. & A.I., notably Articles 1194, para.4 and 1936-7-8 and A.F.O. amendments to these regulations.

(a) Losses by accident or theft are to be reported through Administrative Authorities with full details, including an assessment of negligence if relevant. A copy of the report is to be forwarded to the Hydrographer.

(b) Cases of damage are to be reported to the Hydrographer with similar details including negligence.

(c) Circumstances require to be exceptional for less than full value to be charged to an individual who has shown neglect (vide K.R. & A.I. Art.1936 para.3a. and current A.F.O.s.)

(d) Special precautions are necessary for the safe custody of H.S.9 watches when not in use.

Instructions on supply, use and treatment are contained in Form H.112, supplied with Chronometer outfits, and also in Form H.51. Particulars of the receipt and disposal of chronometers and watches are to be kept on Form H.394.

Chronometers fitted with electrical contacts are on charge to the Navigating Officer although the chronographs with which they are used are Hydrographic Instruments (see para.8).

Page 18 Para 35. delete and substitute:-

"35. Form for calculating Time and Height Differences, Ratios and Tidal Levels (H.15) - This form is intended for the analysis of observations for a period or periods of 29 days of the times and heights of High and Low Water.

It should also be used for a period or periods of 15 days observations, although the differences will be appreciably less accurate than those from longer periods of observations. If the observations are intermittent but cover a period of more than just a few days, they should be entered on Form H.15. Although they cannot be analysed, they may be a useful addition to information already in the Department. This form should be rendered in addition to the forms for Harmonic Analysis H.217, 217A or 217B when continuous observations are obtained. All necessary information relating to time and chart datums, zero of the observations etc., is also to be entered in the space provided. The differences etc. are to be calculated in accordance with the instructions in Professional Paper No. 3 Part II and the forms forwarded to the Department with the Fair Chart of the locality (see para. 76.)"

Page 18 Para 36. The Forms for Harmonic Analysis.

First line, after "(H-217 and H-217A, B and C)", insert:-

"For use with 29 or 15 days observations".

Page 18 Para 37. Forms for Analysis by the Admiralty Method.

Amend heading to read "Forms for the analysis of 24 heights or rates at Lunar-hourly intervals."

Add new paragraph:-

"These forms are to be used for the following purposes:-

- (a) the analysis of tidal streams observed outside European waters (see para. 92).
- (b) The transference of datum when the diurnal component of the tide is relatively large (See Manual of Surveying p.302)
- (c) The analysis of tidal observations when circumstances do not permit observations for 15 days or longer (see para 36)

	Foreign Ship	Home Ship	SCPS	SML.
General Instructions for Hydrographic Surveyors	12	8	3	2
Admiralty Manual of Hydrographic Surveying	6	4	3	1
Admiralty Manual of Tides	4	2	1	1
Admiralty Manual of Navigation Vol III.	2	1	1	1
Text Book of Topographical Surveying (Glose)	2	2	1	1
Air Photography applied to Surveying (Salt)	1	1	-	-
Hydrographic Manual (U.S.C & G.)	1	1	-	-
Plane and Geodetic Surveying (Clark) Vols I & II	1	1	-	-
Survey Computations (G.S.G.S.)	1	1	1	-
Notes on Minor Trig. (Ordnance Survey)	1	1	1	-
Notes on Minimum Error Conical Projections (H.D.)	1	1	-	-
Construction of Radar Calibration Charts (H.D.)	1	1	-	-
Ordnance Survey Sheet Line Co-ordinate Data (H.D.)	1	2	2	1
Rectangular Co-ordinate Projections (Redfearn)	1	1	-	-
New Manual of Logarithms (Bruhns)	3	3	1	1
Logarithms of sines & tangents to every second				
(Shortrede)	3	3	1	1
Chambers' 7 figure mathematical tables	3	2	2	-
Five figure logs and other tables (Castle)	3	2	2	-
8 figure tables of trigonometrical functions (Peters)	1	1	-	-
Inman's Nautical Tables	2	1	1	1
Tables for facilitating the calculation of heights				
(Purvey-Cust)				
large	2	2	1	-
small	6	6	2	2
Practical Optics (Johnson)	1	1	-	-
Theodolite design and construction (C.T. & S.)	1	1	-	-
Spherical & Practical Astronomy (Chauvenet) Vols I & II	1	1	-	-
Apparent places of Fundamental Stars.	1	-	-	-
Notes on the Standard (Unabridged) Nautical Almanac				
(H.D.365)	2	2	-	-
The prediction and reduction of Occultations	1	1	-	-
Astrolabe Tables (H.D.413)	2	1	-	-
Notes on the working of the New Navigation (Ball)	1	-	-	-
Extract from the Manual of Astronomical Observations				
for Lat. & Long. (Canadian Dept. of Interior)	1	-	-	-
Founders of Oceanography (Herdman)	1	1	-	-
Science of the Sea (Fowler & Allen)	1	1	-	-
The Oceans (Sverdrup, Johnson & Fleming)	1	1	-	-
The Main Characteristics of Sea Water.	1	1	1	-
Tables for the velocity of Sound in Sea Water (H.D.282)				
and Supplement	2	2	1	1
Echo Sounder Velocities (British Isles & N. Sea)	1	1	1	1
Wind Waves at Sea, Breakers and Surf (U.S.H.O.)	1	1	-	-
Hints to Travellers (R.G.S.) Vols I & II	1	1	-	-
Handbook of Instructions to Collectors (B. Museum)	1	1	-	-
Nature Notes for Ocean Voyages (Carpenter & Wilson)				
Barker)	1	1	-	-
Geology for Beginners (Watts)	1	1	-	-
Alphabets of Foreign Languages (Gleichen)	1	-	-	-
How British Admiralty Charts are produced (Hayes)	1	1	-	-
An Introduction to Charts & their Use (Hayes & Chriss)	1	1	-	-
Surveying in Peace and War (H.M.S.O.)	1	1	1	-
Sea Surveys (Edgell)	1	1	1	-
Specimen type faces	1	1	1	-
English Channel Handbook	-	1	1	1
Manual of Map Reading, Photo Reading & Field Sketching				
(H.M.S.O.)	1	1	1	-

Page 26 Para 51(c). Articles which have to be specially purchased by H.M. Stationery Office.

Lines 18 & 19. for "Tracing, Harding's, No.498b"  
read : "Tracing, Harding's, No.498c"

Page 27 Para 51(c). (continued)

Insert in alphabetical sequence:-

"Erasing Paste, diamond"  
"Scotch Tape"

Page 27 Para 52. Add to first sub-paragraph:-

"and is to be taken on charge (quoting the serial number) in the Instrument Account Form H.77."

Page 31 Para 60. Triangulation. Sub-para 3 after "if obtainable" add:- "When triangulation data is required for a survey and has not been supplied with the Hydrographic Instructions for the work, application should be made to the Hydrographer."

Sub-para 4, after "the same point of origin." add new sub-paragraphs:-

"When in the case of triangulation abroad local triangulation does not exist, suitable points having a good view to landward are to be included in order that the connection of future land surveys to our triangulation may be effected.

Arrangements have been made with Military and Colonial Surveys similarly to include points useful to the Hydrographic Surveyors in all their future triangulations, thereby ensuring that maps and charts can be accurately combined and topographical maps used for the correction of charts."

Page 31 Para 61. Rendering of Triangulation Data.

Amend all on page 31 to read:-

"Triangulations are to be rendered in typescript in duplicate on one side only, with a triplicate copy for retention onboard, all three copies being made on the special paper provided and the typed pages bound in binder H.58 supplied. "Original, Duplicate or Triplicate" is to be boldly shown on the outside of the appropriate binder.

The data required are comprised in a diagram and nine sections which are to be assembled in accordance with the list below. Care must be taken to avoid alterations and erasures and to see that every figure and letter is legible and of even thickness.

A typewriter with two-colour ribbon (and "hard" rollers),

colours red and black, is supplied for use in this connection.

RED is to be used for information accepted, e.g. data from former surveys whether land or hydrographic, angles or triangles adjusted in a former figure etc. On the carbon copies "red" information should be underlined in red ink.

Stations from former surveys are to be lettered A, B, etc. in RED and those of the new survey listed next as A, B, etc. in BLACK (continuing Aa, Ba, etc. if necessary). Small letters a, b, etc. are to be used for secondary stations.

When floating beacons are used, "moored" or "anchored" is to be stated in the list of Stations and double or single anchors shown in the diagram.

The General Locality, Title of Survey, Name of ship and Year are to be typed at the top of every sheet.

DIAGRAM OF TRIANGULATION - To be drawn on tracing cloth on a convenient scale and placed in the pocket provided. The rough coastline is to be indicated, land tinted and scale and meridian inserted. Stations from accepted information are to be shown in RED, floating marks in BLUE and all others in BLACK. Main Trig Stations are to be indicated by a circle surrounding a triangle; other stations without triangles. All stations are....."

Page 32 SECTION 1 - last paragraph, last line

For "green" read "RED"

SECTION 2 - delete second sub-para and substitute:-

"The description is to include a list of stations accepted from former surveys, quoting the source and the name and/or letter used in those surveys as well as the letters adopted for the new survey".

SECTION 3 - delete second and third sub-paras and substitute:-

"Observed Angle. Adjusted Angle. Sine of Adjusted Angle. Where only two angles of a triangle have been observed, the third angle is to be left blank in the LIST OF OBSERVED ANGLES but its deduced value after adjustment must be shown in the LIST OF ADJUSTED ANGLES.

Sextant angles are to be distinguished by the abbreviation "Sext" after them."

Delete last two lines of last para of this SECTION and substitute:-

"are to be shown in RED, whilst triangles adjusted in previous polygons are to be shown in brackets."

SECTION 4 - In the last line of this SECTION for "green" read "RED".

Page 33 SECTION 8.add new sub-paragraph:-

"Efforts should be made to obtain the names and ages of as many of the local inhabitants as possible who have seen the Station. A list of such names is to be recorded on the back of Form H.159.

When possible, diagrams of Stations should be accompanied by aerial photographs on which the paths leading to the Station should be marked; and photographs can be used to illustrate the Stations themselves. When photographs are used, one print is to be included in each copy of the triangulation data; negatives are not required."

Page 38 & 39 Paras 73, 74 and 75 are cancelled.

Page 38 Para 73.insert new paragraph:-

"73. Measured Distances. - Information about Measured Distances is issued by the Department on Form H.4. The accuracy of the information is frequently invalidated by the moving of the beacons without a report being made to the Hydrographer. When a Measured Distance lies in an area under survey the beacons are to be included in the Triangulation."

Page 42 Para 81.Beach Gradients. delete paragraph and substitute:-

"81. Coast and Beach Intelligence.- A detailed knowledge of the coastline and beaches is required in war and may also have a peacetime application. The following instructions define the requirements of a survey in foreign waters unless special instructions are received.

COAST. Attention should be paid to the following points:-

(a) Landing from boats. Difficulties due to rock pools, coral reefs, weather conditions. Negative as well as positive information is of value.

(b) Difficulties close inshore, not obvious from the Fair Chart.

(c) Paths, tracks, or, on a cliff coast, scaleable gullies.

(d) Isolated quays, jetties, piers etc. giving position, type of construction, state of repair, types and number of cranes, landing steps, exits, height above H.W., depth alongside, tidal data.

BEACHES. Attention is to be paid particularly to beaches half a mile long and perhaps suitable for large scale landings, and all beaches within five miles of a port,

the following points in such areas being important:-

(e) The bearing surface determined by inspection and walking over it or by trial with wheeled vehicles if available. Geological samples are not required but it should be established that the sand is not an overlay, say a foot or less in depth, over clay or mud. This may be determined by driving a pipe or Baillie rod into the beach at suitably spaced intervals.

(f) Exits, with their suitability for heavy traffic.

(g) Runnels, pools, boulders or other obstructions to wheeled or tracked vehicles.

(h) Holding ground immediately offshore. Effect of wind and surf on landing conditions.

GRADIENTS. Gradients of the bottom from the 3 fm. line to the high water line and thence to the back of the beach are to be obtained. Three such lines in half a mile will suffice unless the configuration of the seabed varies appreciably. If the coast is rocky and steep with intervening sandy bays, or is a very long and regular sandy formation, representative lines are to be run. E/S and taut wire gear readily obtain the data, completed by levelling on shore. Forms H.408 (Plate 3) are to be used for rendering the information.

PHOTOGRAPHS. Photographs are of value to those not familiar with local conditions, and should be taken from the immediate approach and other directions as may best illustrate the report on the beach.

REPORTS. are to be compiled for suitable stretches of the coast, headings clearly describing the location and extent. A tracing (on cloth) is to be forwarded showing the location of the gradient lines and the exits, with the topography in the vicinity sketched in. The scale is to be that of the survey or at least 1:50,000 if the survey is smaller. A larger scale should be used if the detail warrants it. The name(s) of the surveyor(s) responsible is (are) to be included. These reports will be additional to and separate from Sailing Directions revisions, and are to be forwarded in duplicate with the Fair Chart.

PRO FORMA. For the really important beaches, information should be rendered in the Pro Forma supplied."

Page 44. Para.89.Views. delete the paragraph and substitute:-

"89. Views.- Views must be made of leading lines, clearing marks and stretches of the coast for inclusion in Sailing Directions or on charts whenever

a useful purpose will be served. Detailed instructions will be found in the Admiralty Manual of Hydrographic Surveying.

Views are liable to become out of date owing to changes in topographical detail; they must therefore be checked and, if necessary, redrawn or photographed. Existing views are also to be checked as opportunity offers on passage. Those requiring revision, which cannot be undertaken at the time, as well as those which no longer fairly represent the detail or serve a useful purpose, are to be reported. See para 155.

Page 44

Para. 91. Wrecks.- Delete and substitute:-

"The existence of large numbers of wrecks in navigable waters at home and abroad, mainly caused by the hazards of war, has greatly increased the responsibility of the Surveyor when carrying out his normal duties, and he must satisfy himself that all wrecks within the area of his survey are located. The least depth over any which might be a danger to surface or submarine navigation must also be ascertained; in the former case the least depth must be obtained with all possible precision, usually by drift sweeping; in the latter case a lower standard of accuracy can usually be accepted and sufficiently close results may be obtainable by "starring" over the position with the echo sounder.

Where wrecks have been dispersed and are charted as "foul", they may form an obstruction to anchoring or trawling and the area is to be closely echo sounded and/or swept to ascertain whether the foul ground continues to exist or whether the symbol can be expunged from the charts. In important anchorages it may be necessary to examine the bottom with divers.

A list of wrecks reported to lie within the area under survey will be supplied by the Hydrographic Department as an appendix to the Hydrographic Instruction for the survey, together with all the available information concerning them. This does not, however, absolve the surveyor from the duty of obtaining any local information regarding wrecks which may supplement that available in the Department.

Attention is directed to the following points:-

- (1) So long as a wreck continues to be an obstruction, to navigation or any other form of marine activity, e.g. anchoring, trawling etc., it must appear on the charts.
- (2) In addition to wrecks, any object which gives a "non-sub" echo must be fixed and recorded in the Departmental records.
- (3) The onus is on the surveyor to disprove, or otherwise, every charted wreck, obstruction or non-



sub, and until they are disproved they must remain on the charts or in the records.

The reports on all searches for wrecks, which are to be in the fullest detail and are to be accompanied by tracings showing areas examined by A/S gear and/or swept, with the depth swept to, obstructions and non-subs located etc., are to be forwarded on conclusion of the survey. Uncharted wrecks dangerous to navigation, and those whose charted depth or position is seriously in error, are to be reported immediately, if necessary by signal.

Care must be taken to avoid passing over a wreck with the ship until confirmation has been received that a safe depth exists. If necessary a clearance sweep is to be first carried out by boats or with an Oropesa sweep with the ship, before drift sweeping is commenced. Failure to observe this precaution has resulted in damage being sustained by a Surveying Ship. (See also paras 66 and 127)"

Page 45. Para.92. Tidal Streams:-

delete last paragraph and substitute:-

"All analyses are to be carried out in accordance with the instructions referred to and sent in to the Hydrographic Department, with the observations and computations, both tabular and graphical, as shown on pages 89 to 92 of Admiralty Manual of Tides, Part III, 1941.

Forms H.224 A, B and C (Form for the analysis of 24 heights or rates at lunar-hourly intervals) are to be used for observations outside European Waters. (See para 37)"

Page 46 Para. 94. Observations for variation on shore.

Add new sub-paragraphs:-

"As a standard practice, observations for magnetic variation on shore are to be made with the non-magnetic Tavistock theodolite or the new Vernier V300 theodolite fitted with tubular compass.

Observations are only to be made with instruments which have been tested at the Royal Observatory; these will have their errors recorded in the lid of the box.

Tubular compasses need careful handling and the needle must be kept locked when not in use. Should a compass appear sticky or to be giving bad results, it may be stripped and cleaned by washing the jewel and pivot in spirit. An adjustment of the dip balance weight on the needle may also be necessary. An

An instrument which continues to be apparently defective must be reported. Results of observations are to be forwarded on completion showing clearly what corrections have been applied.

Page 46. Para. 95. Observations for variation afloat. Insert new sub-para after the heading:-

"In many parts of the world it is becoming increasingly difficult to compute the probable position of the curves of equal magnetic variation shown on Admiralty Charts 2598, 3775, 3776, 3777 and the correct value is in some places doubtful to within several degrees.

Ships on passage, when in waters of suitable depth, are invariably to arrange to obtain a series of observations at as frequent intervals as practicable, particularly in areas where isogonic lines run close together, but where a series cannot be arranged isolated sets of observations are always of value. When the true variation is required .....

After the last sub-para "which should be amended as necessary." add new sub-paragraph:-

"No special precautions are necessary in respect of normal D.G. installations. Any residual errors due to the D.G. coils should be less than those inherent in the normal observation using the ordinary ship's compass equipment. It is inadvisable, however, to make observations within 2 or 3 days of deperming or wiping operations."

Page 47 Para.96. Observations for geographical positions.

Add new sub-paragraph:-

"The use of a theodolite in conjunction with the Marc St.Hilaire Method for obtaining geographical position is described in "Notes on the Working of the New Navigation (Ball)" and "Extract from Manual of Astronomical Observations for Lat. and Long.", both supplied in the Surveying Library (see para 46); a method of obtaining a position with accuracy, in circumstances which do not permit the use of an Astrolabe or of a theodolite for separate latitude and Longitude observations is recommended in the manual."

Page 48 Para.98. Nomenclature. After "and perplex the memory" add new sub-paragraph:-

"This instruction is to be generally followed in the case of surveys abroad only. Should it be necessary to name new features in surveys of Home Waters, the Commanding Officer is to propose suitable names for the Hydrographer's approval and await his decision before adopting them."

Page 49 Para.99. Deep sea soundings.- First line on page 49 for "are to be forwarded in triplicate" read "are to be forwarded in duplicate".

Page 58 Para.120. Styles of lettering on the Fair Chart.

Delete all reference to DOUBLE STONE ORNAMENTED, DOUBLE STONE SHADED, SINGLE STONE SHADED, ROMAN ORNAMENTED and ROMAN SHADED.

After "SINGLE STONE OPEN" - delete "Instead of Single Stone, Shaded. All in capitals." and substitute:-

"All words to be in capitals. To be used for Titles of Fair Charts."

After the above sub-paragraph add:-

"SINGLE STONE SHADED - May be used in place of the above. All in capitals.

TIMES ROMAN.-For the titles of small Fair Charts, insets and tracings. All in capitals."

Page 63 Para.146. The title of the fair chart.-

delete:-

"Assisted by ... .. Print"

Add new paragraph:-

When a survey is executed by a tender or detached party the Officer carrying out the survey is to be shown against "Surveyed by..." followed by the name of the tender, if any, and "Under the direction of" the Officer in Charge of the Parent Ship, together with the ship's name. The latter Officer is to approve the resulting Fair Chart or tracing.."

Page 64 Para.147. The Memoir.- Add sub-para (xii) as follows:-

"(xii) A list of surveying personnel employed on the survey. This is to include all Assistant Surveyors and Surveying Recorders 1st Class."

Page 70. Para.170. Returns:- Amend list of returns as follows:-

line 1. for "Surveying Records" read "Surveying Recorders".

lines 4 & 5. Delete the words "Together with Tracings of areas surveyed" and "See para.171". last return in list (Statement of Surveying Pay):- delete all reference.

Add to list of returns:-

"M.S.Requirements of Compo Rations 30th Spt.See §209"

Page 70. Para.171. delete paragraph and substitute:-

"171. Reports on Surveying Motor-boats or their equipment, including annual reports on echo sounding gear, are always to quote the number of the boat."

Page 71. Para.172. Return of survey (Form H.-68). Add new sub-paragraph:-

"Officers in charge of surveys on Foreign Stations are to take every opportunity to discuss future surveying requirements with the Staff of the Commander-in-Chief. Enquiries should be made as to what areas on the Station are likely to become of operational importance in the event of emergency, and existing charts should be carefully examined to see whether they will meet Naval requirements. In this connection it must be remembered that operational and planning staffs have not necessarily the technical knowledge to enable them to judge from the appearance and title of a chart the degree of detail in which the various surveys have been carried out. Experience has shown that many anchorages and small harbours of minor importance in peacetime may be extensively used in war; and existing surveys, even if modern, may be on too small a scale or otherwise inadequate for war requirements."

Page 72. Cancel existing para. 174 and substitute:-

"174. Pilotage Allowance.- Surveying Officers, whether in appointments carrying surveying pay or not, may submit claims for pilotage under the general conditions of O.U. 5254/38 when they are engaged on ordinary navigation between ports or between port and surveying ground. Claims are not to be submitted for pilotage in an area which is being surveyed, e.g. a ship surveying a part of the Thames Estuary would not be entitled in respect of movements in the Estuary necessitated by her surveying activities.

(1) Claims are not to be submitted in an area which has been surveyed during the period of the appointment of the navigating officer concerned.

(2) The term "area which is being surveyed" is to include an examination or wreck survey within a pilotage area.

(3) The Commanding Officer forwarding a claim is to certify thereon that "The pilotage claimed relates to ordinary navigation and there has been no surveying activity within the area (vide General Instructions to Hydrographic Surveyors para 174)".

Page 72 Para.175. Quarterly statements of surveying pay, etc. delete the paragraph.

Page 77 Para.183. Commissioned Non-Executive Officers,- delete the paragraph.

Paras 191 & 192. Notices to Mariners concerning surveying operations, and Promulgation of positions of floating beacons.

delete both paragraphs and substitute:-

"Para. 191. Warning Notice of Surveying Beacons.- It is desirable that fishermen and other mariners should be warned by Admiralty Notices to Mariners or by other means, of the existence of beacons or dan buoys laid for surveying so that, on the one hand, damage to fishing nets etc. and, on the other, the destruction of survey marks with resulting delays, may be minimised. Commanding Officers are accordingly to report their intentions in advance.

It should also be remembered that an off-shore tide pole may be a danger to inshore fishing and that local warning would in such a case be necessary.

The procedure for notifying the existence of beacons and buoys laid for surveying operations is as follows:-

In Home Waters. The report is to be made at least a month in advance of beacon laying, to permit time for an Admiralty Notice to Mariners to be issued and distributed. The report is to be addressed to the Hydrographer, with copies to the Chief Inspector of Fisheries, St. Stephen's House, Victoria Embankment, S.W.1., and to the Senior Officer, Fishery Protection.

The report is to describe the area concerned and give the probable period over which the beacons will be used. If any beacons are to be lit, their intended position as well as the character of the lights is to be given.

Any appreciable alteration in the original intention is to be reported and, finally, the lifting of the beacons, so that the Notice to Mariners may be cancelled.

Abroad. Similar reports are to be made to the Commander-in-Chief, with copy to the local Senior Naval Officer and/or Marine Superintendent. Should it be considered that other than local promulgation is required, e.g. owing to the vicinity of a main shipping route, a request for a Station Message should be included with the report to the Commander-in-Chief. It would be exceptional to issue an Admiralty Notice to Mariners.

Local Action. Commanding Officers should not hesitate to consult local Fishing and Marine authorities and, when practicable, to adjust the positions of beacons to mutual advantage.

If only one or two beacons or dan buoys are to be used in positions which are unimportant to other vessels or for a short period, it will be sufficient to advise local authorities only.

Page 81. Para 196. Extra issue of provisions.-

add at end of paragraph:- "(See § 209)".

Page 81. Para 197. Gratuitous issue of clothing.-

add new sub-para:- "Each surveying ship may carry 20 URSULA WATERPROOF PROTECTIVE SUITS and each S.M.L. 4 suits whilst surveying in Home Waters. They are for the use of officers and men employed on boat sounding or other exposed survey work. They are expensive items and are to be used only for the purpose for which they are supplied."

Page 82. Para 202. Promulgation of information on surveying subjects.- Add new sub-paragraphs:-

"Selected papers contributed by personnel in the Department or Service on surveying, cartography, process-production etc., will be promulgated as Professional Papers. In accordance with Admiralty principles the Hydrographic Department will sponsor the papers and the name of the author will not appear. A paper may, however, be reproduced verbatim as from a member of the Chart Branch, the Commanding Officer or an officer of H.M.S...., a member of the Hydrographic Supplies Establishment etc., with a foreword of Introduction or criticism by the Hydrographer. Professional Papers should be typed on foolscap folio pages in sufficiently polished form for reproduction. Illustrative drawings and diagrams can be embodied. Though promulgation will be mainly within the Department and the Surveying Service, some papers will be given a wider distribution among Hydrographic Offices in the Dominions and Foreign Countries, Universities, Scientific Libraries etc."

Page 83. Para. 205. Hard Lying Money.- delete and substitute:-

"Hard Lying money is not payable to officers in receipt of surveying pay.

The conditions governing the payment of Hard Lying Money to non-surveying officers and to ratings are contained in K.R. & A.I., Vol.I Article 1638(2) and A.F.O.1294/49 para.480.

With reference to sub-para.1 of para.480 of the A.F.O., "exceptional circumstances" are to be regarded as only applying to a survey ground in which the work is continuously in open waters and necessitates remaining under way or in an exposed anchorage each night. They do not apply to passages through open waters from place to place nor between a port and the survey ground though there may be some protraction of the passage to carry out small survey tasks.

It will in fact be most exceptional for the circumstances to justify a representation by Commanding Officers for the payment of Hard Lying Money."

Page 83. Insert new paragraph 208.

"208. Visits of Surveying Officers to London and Taunton. It is desirable that visits should be paid by all Surveying Officers to the Hydrographic Department at Cricklewood and the Hydrographic Supplies Establishment at Taunton. By this means officers will gain an insight into chart compilation and reproduction methods, whilst at the same time a closer personal liaison between sea-going officers and the naval and civilian officers in these establishments will be built up.

These visits should normally be arranged when ships are laid up for refit in Home Ports."

Page 83. Insert new paragraph 209.

"209. Issue of Compo Rations.- A 10 man Composite Ration Pack is issued to Surveying Ships at Home and Abroad for the use of detached parties (e.g. Tide Watchers or Surveying Parties working away from the ship for periods longer than one day).

The Compo Rations are to be issued to detached parties only and not to boats' crews, since the pack contains sufficient quantities of tinned food etc. for 10 men for 24 hours. If they were issued to boats' crews instead of surveying rations, the crew would have to be checked out of the ship and no other provisions issued. This, besides throwing a larger volume of work on the Victualling staff, would result in the abolition of surveying rations, which now supplement the normal standard ration in compensation for the additional hours spent in boats or in the field. Victualling allowance will not be payable in addition to the issue of packs.

Compo Rations are drawn by the Director of Victualling from Army stocks only as and when required, and it will be necessary to provide notice of Surveying Ships' annual requirements. Ships are to report to the Hydrographer on 30th September their anticipated requirements for the 12 months commencing from the following 1st January. Nil reports are required. Home ships will be supplied when storing up in preparation for the surveying season. Foreign ships are to include in their reports the destination to which the Packs are to be consigned, if possible to make a forecast."

Page 83. Insert new paragraph 210.

"210. Alterations and Additions.-

The procedure for rendering Alterations and Additions is given in detail in A.F.O.s 892 and 893 of 1947.

Surveying Ships and Motor Launches are included in

the "Ship System". Commanding Officers of S.M.L.s submit lists of A. & A.s through the parent ship.

Alterations and Additions approved for the class lists of "Halcyon", "Hebe" or "Bay" class ships do not affect Surveying Ships which have been converted from those classes unless this is specifically stated. Alterations and Additions will be issued by Admiralty Letter or in Fleet Orders separately for Surveying Ships.

In forwarding proposals for Alterations and Additions, Surveying Ships are normally to follow exactly the same procedure as other H.M. Ships, i.e. forms S.1182 or S.1182b are to be forwarded to the Secretary of the Admiralty through the ship's Administrative Authority. If, however, major alterations to surveying equipment and/or upper deck fittings, including proposals to revert to discarded types, are considered desirable, such proposals should first be submitted direct to the Hydrographer only. The ship concerned should then await a direction from the Hydrographer before putting them forward through the usual channels."

Page 83. Insert new paragraph 211.

"211. Local Authorities- Requests from, for copies of surveys:-

Copies of unclassified surveys may be supplied to Local Authorities on request. Each copy is to carry the following NOTICE in conspicuous lettering and is to be signed by the Commanding Officer.

"Copy of a survey by H.M.S.....

Date.....

Supplied by permission of the Hydrographer of the Navy for the official use of

.....

This copy is supplied for the use of the above-named person only on condition that it is not reproduced, published or issued to any other person. It has not been checked for errors or omissions and the Hydrographer of the Navy accepts no responsibility for the information shown.

Signed .....Commanding Officer.



Page 83. Insert new paragraph 212.

"212. 16 ft Motor Skiffs - Reserve Buoyancy.-

The 16 ft. motor skiffs carried by Surveying Ships have very little reserve buoyancy and will certainly have negative buoyancy when equipment such as Type 766 E/S gear is carried.

It is undesirable to add further buoyancy tanks to these boats, and orders should be issued for the removal of E/S and other heavy equipment from the boat whenever it is not actually required for surveying purposes".

Page 84.

Under AIR PHOTOGRAPHS add "Triangulation Station"... 61  
 After ALLOWANCE insert "Alterations & Additions"....210  
 Under ANALYSIS for "By Admiralty Method" read:-  
     "of 24 hours series; forms"..... 37  
 Under ASSISTANT SURVEYORS delete  
 "Non-executive officers employed as.... 183"  
 After ASTROLABE insert  
 "Balloon outfits..... 10"  
 After BASES insert  
 "Batteries, replacement of..... 2"  
 BEACH gradients. Add "and Intelligence"  
 Under BEACONS against PROMULGATION OF POSITION OF  
 for "192" read "191"

Page 85.

After CLOTHING insert "COAST & BEACH INTELLIGENCE... 81"  
 After COLLECTOR insert  
 "Colonial surveys, consultation with..... 60"  
 After COMPLIMENTARY insert "COMPO RATIONS..... 170,209"  
 After CO-ORDINATES insert  
 "COPIES OF SURVEYS FOR LOCAL AUTHORITIES..... 211"  
 Under DATUM FOR delete  
     "Soundings.....73"  
     "Soundings, Estabt. of.....74"  
     "Soundings, transfer of .....75"  
 Under DIAGRAMS insert "Beach gradient ..... 81"  
 After DRAUGHTSMANSHIP insert  
 "DRAWING PAPER, care of ..... 117"  
 Under ECHO SOUNDING add  
 "E/S machines, fitting in 16 ft motor skiffs..... 212"  
 Under ESTABLISHMENT OF delete "Tidal datum..... 74"

Page 86.

Under FATHOM LINES add:- "Fixing of... .. 68"  
 After FIELD insert:-  
     "FIGURE OF EARTH, necessity to ascertain ... 60"  
 Under FISHERIES delete:-  
     "Information re beacons to Fishery Cruiser ... 192"  
 Against "Information re beacons to local officers"  
     for "192" read "191".  
 Under GEOGRAPHICAL POSITION add:-  
     "Record of ... .. 32"  
     "Return of ... .. 97"  
 Under HARMONIC against Constants delete "74".  
 Under LEADING LINES, add:-  
     "Views of ... .. 89"  
 Delete "LIVERPOOL datum ... .. 73"

Before LOGS insert:-

"LOCAL AUTHORITIES -	
Correspondence with ... ..	164
Local surveying requirements ... ..	172
Requests for copies of surveys from ...	211

Page 87.	Before MARKING insert "MARC ST.HILAIRE method ..	96"
	Before MEMOIR insert "MEASURED DISTANCES ... ..	73"
	Under MESSING add "Compo Rations... ..	209"

Before MOUNTAINS insert "MOTOR BOATS, Reports on	171"
"MOTOR SKIFFS, Reserve Bucyancy ... ..	212"
Delete "NEWLYN datum ... ..	73"

Under ORDNANCE SURVEY delete "Datum & Bench marks	73"
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Under PHOTOGRAPHS insert:-

"Of beaches ... ..	81
Of triangulation stations... ..	61
Of views... ..	89"

Before PLOTTING insert:-

"PILOTAGE ALLOWANCE ... ..	174
PILOT BALLOON OUTFITS ... ..	10"

After PROCEEDINGS insert "PROFESSIONAL PAPERS.	202"
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After PROFESSIONAL PAPERS insert:-

"PROJECTION, necessity to ascertain ...	60
Protractors (see xylonite) ... ..	6"

Under PROVISIONS insert "Compo Rations ...	209
--	-----

Under QUALIFICATIONS OF - Surveying Recorders for "186" read "184"	
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Under RECORDERS, SURVEYING:-

Delete "Movements... ..	188
Payment of allowances . 184"	
Insert in sequence:-	
"Establishment ... ..	184
Employment of S.R.I.s ... ..	188
Eyesight standard.. ... ..	185
General ... ..	184
Relinquishment of specialist qualification	189
Surveying Coxswain ... ..	190

Delete "RADAR RATINGS... ..	189"
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Under REPORTS ON after "Beach gradients" add:-

"and Intelligence. ... ..	81"
after "Searches for shoals insert:-	
"Surveying Motor Boats. ... ..	171"

Page 88.	Under SHOALS add "Searches for, Reports...	...	165"
	After SKETCHES insert "SKIFFS, MOTOR, reserve buoyancy.	... ..	212"
	Under SOUNDINGS, delete "Datum	... ..	73"
	Insert in sequence "Direction of lines of	... ..	65
	Against "Reduction of" add "67"		
	Under SURVEY insert in sequence:- "By tenders and detached parties	... ..	146
	"Requests for copies of, from local authorities	... ..	211
	Under SURVEYING:- delete "Pay, quarterly statements...	175"	
	against "Operations, N. to M., re" for 192"		
		read "191"	
	against "Recorders" add "(See Recorders, Surveying)"		
	insert in sequence:- "Officers, visits to London & Taunton	... ..	208
	"Subjects, professional papers on	... ..	202"
	Under TIDAL ANALYSIS for "Admiralty Method" read:- "of 24-hourly series"		
	Before TIDAL DATUM insert "TIDAL DATA, Record of		32"
	Under TIDAL DATUM delete "Establishment	... ..	74"
	delete "General Instructions..	73-5"	
	delete "Transfer of	... ..	75"
	Before TIME Signals insert:- "TIME AND HEIGHT DIFFERENCES	... ..	35"
	After TIME Signals, insert:- "TITLES & MEMOIRS, Record of	... ..	32"

Page 89.	Under TRACINGS delete "Of areas surveyed ...	171"
	Under TRAINING OF against "Surveying Recorders" for "185" read "184"	
	After "SURVEYING Recorders" insert in sequence:-	
	"Film strips... ..	185"
	"Training and Advancement.. ..	185"
	"Training guides .. ..	185"
	Under TRIANGULATION insert in sequence:-	
	"Diagram of .. ..	61"
	After TRIGONOMETRIC heights insert	
	"TRUE HEARING, Record of .. ..	32"
	Before VARIATION observations insert	
	"URSULA PROTECTIVE SUITS .. ..	197"
	Under VARIATION OBSERVATIONS add	
	"Variation, Record of .. ..	32"
	Under WRECKS add	
	"Use of Asdics for detecting .. ..	66"

